Radial 8XT Dual Span & Triple Span Radial Sequencer/Inserters

CE

Universal Part Number: GS-403-03
Reference Configuration #48903103 and higher
Issued: 04/03

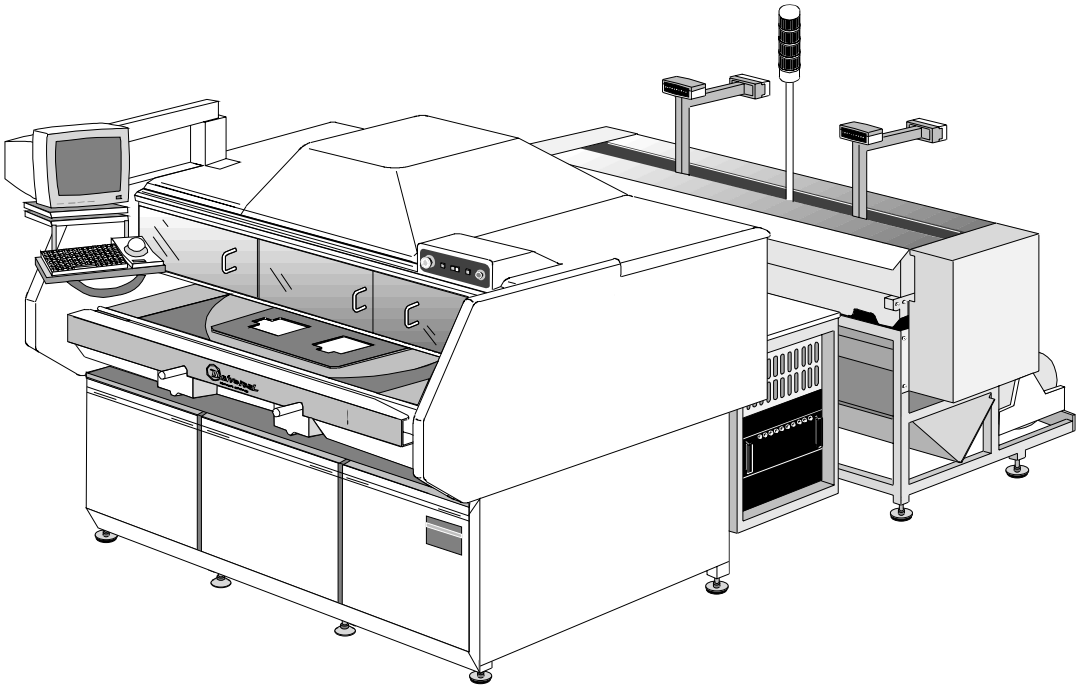
General Specification

Insertion Machine Division of Universal Instruments
Automation in Electronic Assembly

Universal

Insertion Machine Division
Product Line

Radial 8XT
Radial Sequencer/Inserter with Manual Load
(Shown with In-Line Sequencer)



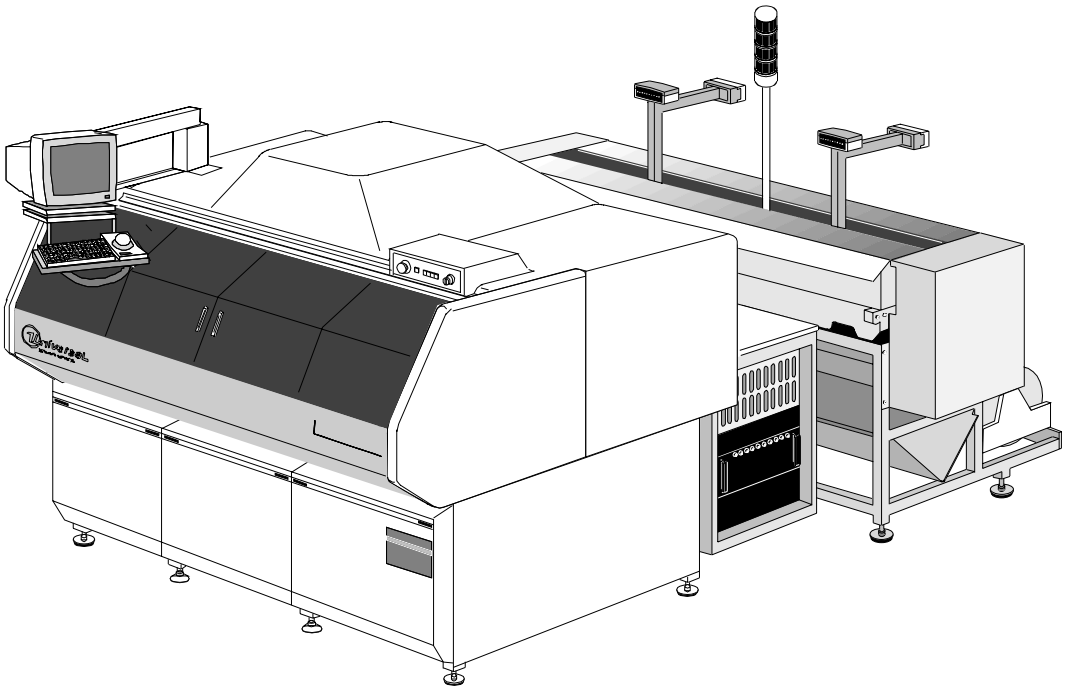
Machine Highlights

- Constant, High-Speed Radial Component Insertion
- Uninterruptable Power Supply, with Battery Back-Up
- VME-Based Machine Controller with Embedded P.C.
- Universal's IM-UPS Menu-Driven Graphical User Interface
- Universal's Positive Axis Control (PAC) Servo Drive Technology
- Available as a Dual Span (2.5mm/5.0mm) or as a Triple Span (2.5mm/5.0mm/7.5mm)

Universal

Insertion Machine Division
Product Line

Radial 8XT
Radial Sequencer/Inserter
Manual Board Load "Non Pass Through"
CE-Compliant



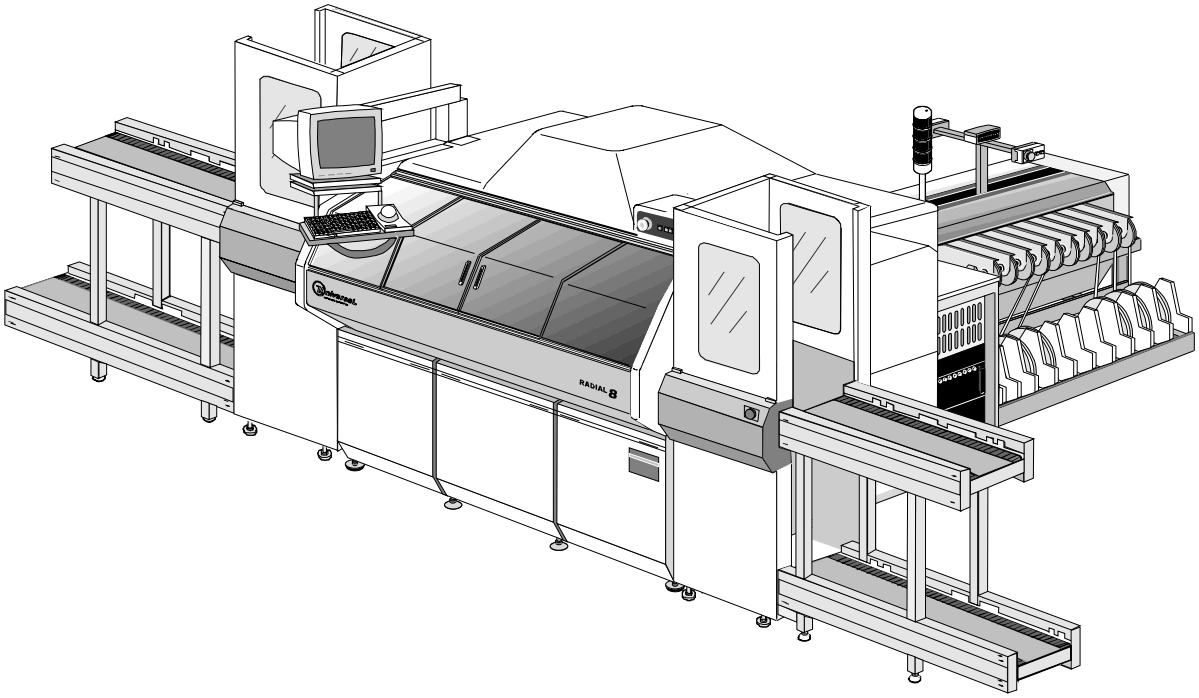
Non Pass Through CE Machine Highlights

- Powered covers leave operator's hands free to load/unload boards
- New circuitry improves interlock recovery time optimizing throughput
- Compatible with existing "stand alone" workboard holders
- Less floor space required compared to machine with automatic board handling

Universal

Insertion Machine Division
Product Line

Radial 8XT
Radial Sequencer/Inserter with Loader/Unloader
(Shown with Straight-Back Sequencer)
CE-Compliant with Optional Protective Covers



Machine Highlights

All the features of Radial 8XT with Manual Load, plus...

- Fast, Reliable PC Board Transfer
- Automatic Internal Board Handling System (BHS)
- Magazine Loader/Unloader, with Motorized Magazine Staging Buffers
- CE-Marked

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Contents

All specifications are subject to periodic review and may be changed without notice. Illustrations may not be drawn to scale.

Indicates a change from a previous edition of this document. Bar alongside text indicates entire section reflects change from the previous edition.

Glossary of Acronyms and Specialized Terms

Acronym/Term	Meaning
AC	Alternating Current: type of electrical power generation
APE	Advanced Product Editor (Universal brand name)
ASCII	American National Standard Code for Information Interchange
AWG	American Wire Gauge: wire size standard
BEC	Board Error Correction (Universal brand name)
BHS	Board Handling System: means of transporting PCBs
CAD	Computer-Aided Design
CD-ROM	Compact Disc-Read Only Memory
CE	Conformité Europeanne: European safety standard
CFM	Cubic Feet per Minute: measurement of air flow
CPH	Components per Hour
CTA	Component Transfer Assembly
DC	Direct Current: type of electrical power generation
ERV	Expanded Range Component Verifier (Universal brand name)
GEM	Generic Equipment Model
GS	General Specification (Universal brand name)
GUI	Graphical User Interface
HSMS	High Speed SECS Message Service: implements SECS2 messaging over a network link
Hz	Hertz (cycles per second): measurement of electrical frequency
IM	Insertion Machine: equipment for through hole component insertion
IMC	Insertion Machine Components
IM-UPS	Insertion Machine-Universal Platform Software (Universal brand name): operating software for Universal Series 8 through hole equipment
I/O	Input/Output
IP	Index of Protection: resistance of machine to contamination by foreign objects
LED	Light Emitting Diode: electrical component
MIT	Machine Interface Translator (VME to I/O bus)
MMIT	Mini Machine Interface Translator (VME to I/O bus)
OS/2®	Operating System 2 (IBM Corp. brand name)
PAC	Positive Axis Control
P.C.	Personal Computer
PCB (or PC board)	Printed Circuit Board
PPM	Parts Per Million: measurement of machine performance
SCFM	Standard Cubic Feet per Minute: measurement of air flow
SECS	Semiconductor Equipment Communications Standard: interface between host computer and assembly machines
SEMI	Semiconductor Equipment & Materials International
SMC	Surface Mount Components
SMEMA	Surface Mount Equipment Manufacturers Association
TCP/IP	Transfer Control Protocol/Internet Protocol: network communication protocol
UCT	Universal Control Terminal (Universal brand name): personal computer for operating IM equipment
UICS	Universal Instruments Control Software (Universal brand name)
UPS	Uninterruptible Power Supply
VA	Volt-Amps: measurement of electrical power consumption
VAC	Volts Alternating Current
VDC	Volts Direct Current
VGA	Video Graphics Array: type of CRT monitor standard
VME®	Versa Module Eurocard (Motorola brand name): industry standard for 32-bit computer bus

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Radial Sequencer/Inserters Introduction and Features Common to Both Dual Span and Triple Span Radial 8XT

Introduction

The Radial 8XT, which can insert up to 21,000 components per hour, is an exceptionally high speed (0.17 sec./ins.) Radial Sequencer/Inserter.

The Radial 8XT may be configured either as a Dual Span or a Triple Span machine. A Dual Span Radial 8XT inserts 2.5 mm/5.0 mm lead span components into printed circuit boards (PC boards). A Triple Span Radial 8XT inserts 2.5 mm/5.0 mm/7.5 mm lead span components into PC boards.

The Radial 8XT may be configured in a straight back or in-line sequencer configuration, with or without internal board handling or loader/unloader.

Selected configurations of the Radial 8XT are CE marked.

Functional Description

Reels or ammo packs of radial leaded components are loaded on the sequencer module, dispensed, and inserted in the programmed sequence.

Component dispensing heads remove components from the carrier tape and place them in component carrier clips located on the sequencer chain assembly. The sequencer chain assembly transports the components to the insertion area. While the components are on the sequencer chain assembly, the carrier tape is removed and the component is verified (if equipped with an optional Expanded Range Verifier [ERV]). The component transfer assembly transfers components from the sequencer chain assembly into the insertion head tooling. The insertion tooling guides the leads through the holes in the PC board. The cut and clinch unit cuts, and then forms the leads, securing the component in the PC board.

Standard Features

Machine Control Systems

VME Machine Controller

The VME machine controller is a rack-mounted multi-processor system with an embedded Intel-based P.C. to support the main operator interface. The operator interface is provided through a color monitor, keyboard, and trackball. The main machine controller is a Power P.C.-based unit, which handles all machine functions and timing.

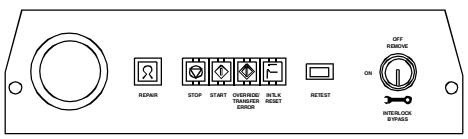
Two four-axis motion controllers are used for Positive Axis Control (PAC) of the insertion head, cut and clinch, sequencer chain drive, and X-Y positioning system. A third four-axis motion controller is used with the optional loader/unloader.

Network Communication Capability

Standard with each machine is a package for computer network connection capability that includes an Ethernet network card and IBM OS/2 TCP/IP client software. This provides high speed, reliable communications and data transfer to all computers connected to the network.

Uninterruptable Power Supply (UPS)

External to the machine, the Uninterruptable Power Supply provides filtered, stable, and continuous power of 230 VAC to the machine. In the event of a power interruption, its fully-charged battery can run the machine for up to 10 minutes, allowing time for a controlled, orderly, manual shut-down of the machine.



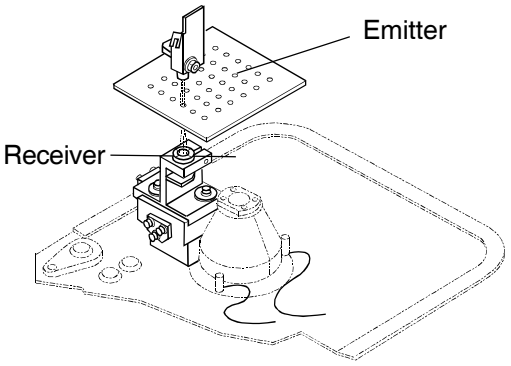
Operator Push-Button Panel

The operator push-button panel provides the controls that the operator needs to run production. All other machine functions are accessed through the graphical user interface via the keyboard, trackball, and monitor.

Auto Recovery

The Radial 8XT features three operator selectable Auto Recovery modes. Each of the three modes notifies the operator through the Graphical User Interface (GUI) if the need to recover is required and displays the recovery options: no repair, manual repair, or automatic repair. The operator can then take the appropriate action and continue populating the PC board with minimal interruption to production.

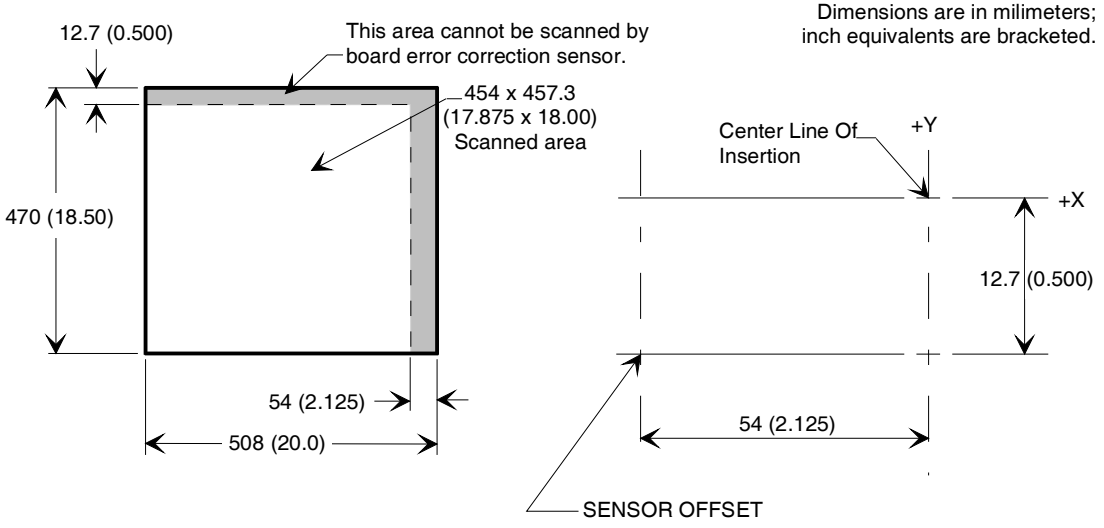
Board Error Correction (BEC)

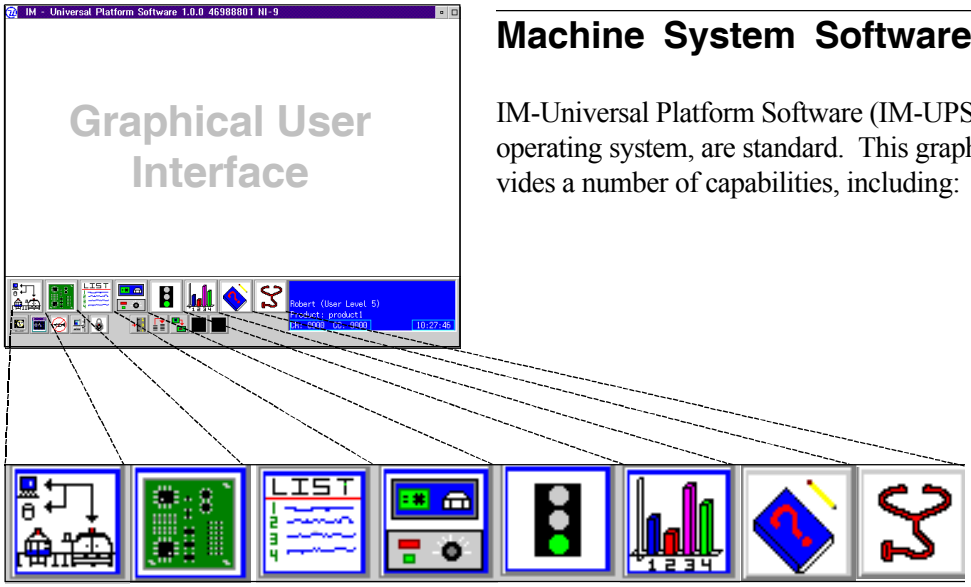


Board Error Correction (BEC) corrects for hole location variations between PC board lots. A light source and receiving sensor are used to sense the variation and make these corrections.

The BEC also includes a Bad Board Sensing feature. Preinspected and indentified bad board segments in a breakaway board array are automatically bypassed during the insertion sequence.

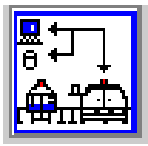
The BEC also provides component lead hole position information for the "Teach" functions resident in the Advanced Product Editor. This unique software feature allows the operator to view, create, and correct component location program data.





Machine System Software

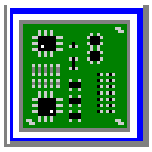
IM-Universal Platform Software (IM-UPS), and an OS/2 WARP operating system, are standard. This graphical user interface provides a number of capabilities, including:



System Setup Icon

System Setup

- Machine Configuration — Displays user-selected configuration of machine options, such as board handling and tooling.
- Event Configuration — Configuration of machine events for display and corresponding control of machine status light and audio alert.
- Security may be configured based on user/function.
- Positioning system dimensioning display (metric or inch).
- Language selection for event messages: English, French, Hungarian, Chinese, Spanish.



APE Icon

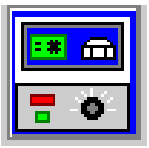
Advanced Product Editor (APE)

- Graphical Program Generation and Editing — Component location can be programmed/edited in either table or graphical format. Graphics display all component insertions relative to the PC board.
- Import of CAD data for program generation.
- Import of existing UICS patterns.

Product Changeover Icon

Product Changeover

- Load Product — Selection of existing products available for production.
- Dispensing Head Set-Up — Compares existing components already loaded with new product component loading requirements for most efficient loading sequence.

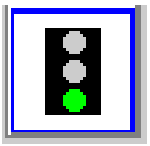


Production Control Icon

Production Control

- Counts — Sets/displays desired product counts.
- Manual Control — Manually controls machine axes.

Machine Status



Machine Status Icon

- Current Messages — Displays current controller event messages and events.
- Product Status — Displays status of running product.
- Feeder Status — Displays low part feeder report.
- Analytic Information:
  - Discrete I/O — Ability to read each input and set each output individually.
  - Event Message History — Ability to view message log.
- Operations — Sets machine modes: Step, Single Cycle, Insert.
- Error Recovery — Displays recovery processes for operational errors.

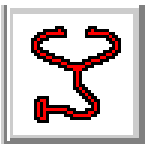
Management Information

Management Information Icon

- Timers — Collection and display of machine timer information: machine ready, production running, etc.
- Counters — Count of machine events: insertions, insert errors, boards, bad board reject, board error correction (BEC), circuits.
- Component Data — Counts by component ID: insertion errors, etc.

A variety of reports can be created from these databases.

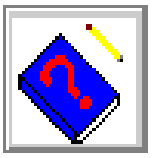
IM Diagnostics



IM Diagnostics Icon

- IM Diagnostics – Ability to exercise machine subsystems on an individual or combined basis outside of machine control software.
- BEC Set-Up/Analysis.
- Machine Set-Up Support.

On-Line Documentation



On-Line Documentation Icon

- IM-UPS documentation is available on-line.

CAD Data Input Specifications

CAD Data Requirements

ASCII File Format — Incoming CAD files must conform to the American National Standard Code for Information Interchange (ASCII). In order to accommodate a wide variety of CAD file formats, the Advanced Product Editor (APE) uses either a generic columnar or separator data translation technique. All data contained in the CAD file is identified by a position in a definition created by the user.

CAD File Requirements

X Coordinate: The X centroid coordinate location on the board.

Y Coordinate: The Y centroid coordinate location of the component insertion.

Theta: The rotation of the component on the board.

Insertion Lead Span: The distance between the centerlines of the component leads.

Reference ID: The name assigned to the component which makes it unique to all other components in the product.

Component ID: The name of the component as it is found in the component database.

Alias ID: The name of a component in the database to which this component is aliased (optional).

Feeder: The number of the feeder from which the component is dispensed. This is a three-digit number (001, 100). If the feeder field is used, the feeder numbers are automatically entered into the feeder list when the CAD file is imported. (“Feeder” is used interchangeably with “dispenser head.”)

BOM-CAD Link: User-defined alphanumeric string which links a line of data in the CAD file to a component ID in the Bill of Material (BOM) file.

Ignore: If the CAD file contains data that does not fit any of the fields, it should be identified with IGNORE.

A sample CAD file format is given with a brief explanation. This file format is provided for reference only and is an example of a typical CAD output. This is a typical CAD file which may be output from a wide variety of different CAD systems.

This file includes SM and IM information, with component information stored for the IM components. IM component information will be obtained from this file and placed into the Component Library.

Information in the CAD file:

A = REFERENCE DESIGNATOR
B = X COMPONENT CENTROID COORDINATE
C = Y COMPONENT CENTROID COORDINATE
D = ORIENTATION
E = PART NUMBER/COMP ID
F = SPAN
G = NUMBER OF LEADS
H = AXIAL BODY DIAMETER
I = MACHINE TYPE
J = DIP SOCKET
K = AXIAL LEAD DIAMETER

```
** <= <= <= <= <= <= <= <= <= <=        NOTE 1        => => => => => => => => => =>  **
**  Each line represents a placement/insertion on the board                        **
*******************************************************************************
  A       B         C    D            E            F     G     H    K         I   J
|   |   NOTE 3   |   | | |  |             | | |  ||  | |  | |         | | | |
0000000001111111111222222222233333333334444444444555555555566666666667777777777
1234567890123456789012345678901234567890123456789012345678901234567890123456789
*******************************************************************************
C1         276     586   90   1206-CAP          NOTE 6                         *
IC1       5170     887   90   8-SOIC                                           *
C2         276    2288   90   1206-CAP                                         *
C3         276    2387   90 N 1206-CAP                                         *
C4         576  N  687   90 O 1206-CAP                                         *
IC2       1900  O 3200  270 T DIP-300-16      300   16                DIP      *
IC3       4000  T 7000   90 E DIP-300-8       300    8                DIP      *
T1         877  E 2789    0 5 SOT-89                                           *
C5         877  4 1987  180   805-CAP                                          *
C6         877    2087  180   805-CAP                                          *
J1         180    2250  180   TEKA-CONN                                        *
IC4       3000    1600    0   68PLCC                                           *
IC5       2000    5250    0   DIP-600-24      600   24                DIP      *
XIC5      2000    5250    0   DIP-600-24-SOC  600   24                DIP  SOC*
T2         877    2288   90   SOT-89                                           *
R1        3550    3200    0   RES-RAD-50      200    2                RAD      *
IC6        877    2488  180   14-SOIC                                          *
IC7       1177    2488  180   14-SOIC                                          *
R3        7000    5000    0   RES-1/4W        500        095  025     AX       *
IC9       3520     950   90   8-SOIC                                           *
R4        5555    4444  180   RES-1/8W        300        080  020     AX       *
C7        3900    6690  270   CAP-RAD-25      100    2                RAD      *
R5        9000    8000   90   RES-RAD-25      100    2                RAD      *
CR1       3100    8500  270   DIODE-AX-2      600        100  025     AX       *
IC10      1177    2388   90   20-SOIC                                          *
```

Sample CAD File Format

Sample CAD File Format Notes:

1. Maximum file width cannot exceed 256 columns.

2. Headerlines, often output by the CAD system, may be used. The CAD Translator allows the user to define the quantity of lines containing the file header. This information is for operator use only and is not used by the CAD Translator.

3. **Format Type:** The format of file. This can be either Table or Separator format (Table is the default).

Table format uses predefined columns for each data type. For example, the reference ID column may be defined as 10 characters. The actual reference ID in the CAD file can contain up to 10 characters. It does not matter if there is data in every column.

Separator format uses a character (comma, space, dash, etc.) to separate data fields. Each line of data must contain the same data types in order for auto detect to work.

# of Fields: The number of fields in the file.

# of Lines: The total number of lines in the file.

4. The CAD file must be devoid of all special control characters such as Tabs. (Note that special characters shown are for illustration purposes only and cannot be contained in the actual CAD file. These characters include boxes, arrows.)

5. CAD data is limited to one component per data file line or row. Additional components are specified on additional lines of the CAD file. There must be no blank lines or rows between any rows of CAD data. Markers such as {EOF} must not be present at the end of the CAD file.

Additional APE Features:

- Import of Existing UICS Patterns — UICS patterns are converted to IM-UPS products.
- Program Optimization — Optimization via “Nearest Neighbor” insertion path.
- Component Identifier and Reference Designator in Product Information — The addition of component identifiers and reference designator in programs supports improved status message reporting and management data tracking by component identifier.

Off-Line Pattern Programming Specifications

The creation of a "product" (pattern program) can be completed on-line, utilizing the machine's embedded P.C., or off-line, using a suitable stand-alone P.C. loaded with IM-UPS software.

Note: IM-UPS software supplied with the machine is licensed only for use in the machine. Software for use in an off-line P.C. is available at an extra cost option.

Universal recommends pattern programming be generated off-line to eliminate production interruptions. This can be done in one of two ways:

- Dedicated P.C. running the OS/2 operating system and Universal's IM-UPS software.
- A standard Windows P.C. with Universal's Virtual P.C. (VPC) and IM-UPS.

The Virtual P.C. option is a Windows application that creates and emulated P.C. using software. This emulated P.C. runs OS/2 and IM-UPS just as a standard P.C. would. VPC runs, along with other standard Windows applications such as the Microsoft Office suite, on a standard desktop P.C. Some of the advantages to this are:

- OS/2 and IM-UPS can run along with standard Windows applications on the same P.C.
- No complex configuration (partitioning and dual boot) is required.

The VPC option is available from Universal as a software package that can be installed on any P.C. meeting the minimum standards described below. Universal also offers a package that includes a new P.C. with the Virtual P.C. and IM-UPS pre-installed.

Minimum Requirements for a Dedicated (OS/2 only) P.C.

Minimum P.C. requirements for creating the product off-line (pattern programming) include:

- 486 processor
- 12 megabyte memory
- CD-ROM drive
- IBM OS/2 Warp 3.0 or 4.0
- 200 megabyte available disc space, on OS/2-compatible partition

For optimum performance in generating the pattern programming off-line, the following capabilities are recommended:

- Intel Pentium™ processor
- 16 megabyte memory
- 500 megabyte available disc space, on OS/2-compatible partition

Note: Installation of OS/2 on an existing P.C. system may require partitioning of the hard drive.

Minimum hardware / software requirements to run the Virtual P.C. (OS/2 and Windows) option:

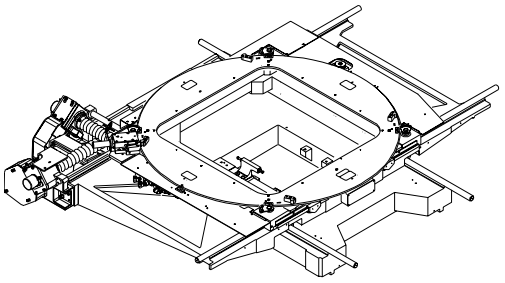
Software requirements:

- Windows 98 (restrictions apply)
- Windows ME
- Windows NT 4
- Windows 2000
- Windows XP

Hardware requirements:

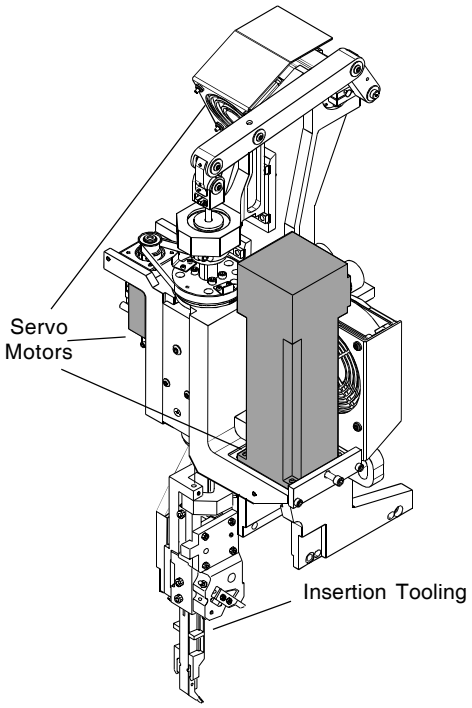
- 256 MB memory
- 500 MHz or better Pentium class processor with level 2 cache or better

Machine Mechanical System



X-Y Positioning System

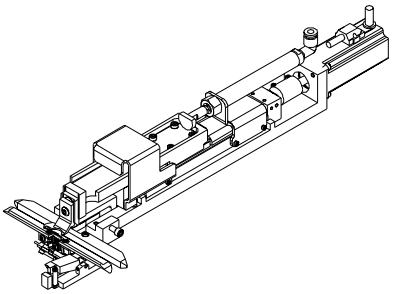
The X-Y positioning system locates the printed circuit board under the insertion tooling and may be equipped with a rotary indexing table that indexes in 90° increments, from 0° to 360° in a clockwise rotation. When the machine is configured with automatic board handling, the table can rotate a full 180° or 270° without 90° stops. This rotary table is air motor driven under pattern program control and requires less than one second to execute each 90° rotation.



Insertion Head Drive

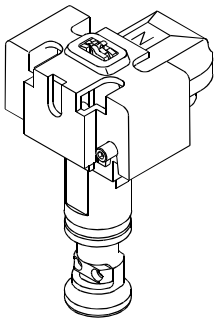
The insertion head drives are servo driven and controlled for precise and rapid component insertion. The insertion tooling may be rotated in 1° increments from 0° to 360°. Mechanical limits prevent the head from rotating between 101° and 159°.

However, components may be inserted at 101° to159° by either: 1) loading the component on the dispensing head at 180° and reversing the direction of the insertion head (ie. 165° head rotation becomes 345°); or 2) rotating the table (ie. 165° head rotation becomes 75° after indexing table 90°). User friendly product editor software simplifies programming in 1° increments.



Component Transfer Assembly

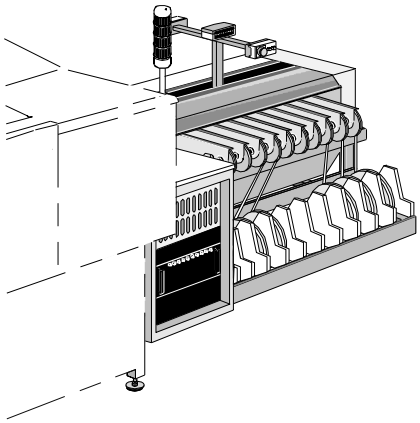
The Component Transfer Assembly (CTA) transfers components from the component carrier clips to the insertion head tooling.



Cut and Clinch Assembly

The cut and clinch is servo driven and controlled for rapid and precise positioning during the cut and clinch process. This positioning corresponds to the programmed insertion head rotation.

The cut and clinch operates in a two stage fashion. The full down clearance for the radial clinch is approximately 15.8 mm (0.622"), and the mid-position clearance is approximately 7.62 mm (0.300").

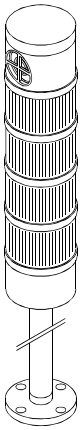


Component Sequencer Module

The sequencer module stores, dispenses, and transports the components to the insertion area. Sequencer sizes are available in increments of 20 component stations (i.e., 20, 40, 60, 80, or 100) up to a maximum of 100 stations. Electrostatic dissipative material for component input stations and low part sensors is available as an option.

Low part sensors located on the sequencer module provide the operator with advanced warning of low components. Stopping the insertion process for component reloading is not necessary due to this advanced warning. Low parts status is displayed on both the P.C. monitor and the tower attached to each component sequencer module.

Component dispensing heads are available to accept either 12.7 mm or 15 mm pitch component input tape. The 12.7 mm and 15 mm dispensing heads are interchangeable in any combination and quantity. (Component dispensing heads are ordered separately. See Optional Features.)

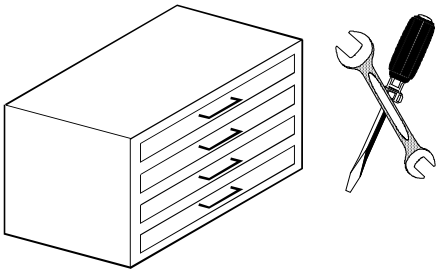


Machine Light Tower

The machine light tower indicates the operational status of the machine with the following color lights. Each of the lights and the audio alert are user programmable.

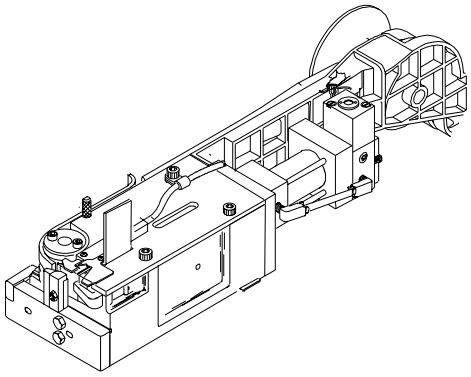
- Audio Alert Module
- Red
- Yellow
- Green
- Blue

Tool Kits



- A kit containing basic hand tools and common hardware items is included with each machine.
- An optional Site Calibration Tool Kit contains special tools required for machine calibration, only one kit is required per customer site.

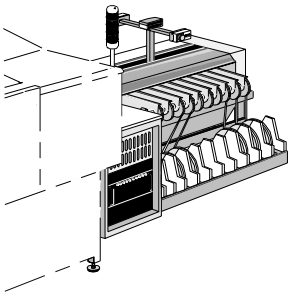
Optional Features



Component Dispensing Heads

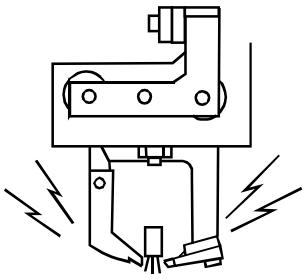
Dispensing heads are available in 12.7 mm or 15 mm pitch. The 12.7 mm and 15 mm dispensing heads are interchangeable in any combination and quantity. All components enter the dispensing head in a body up, lead down orientation. The components remain in this orientation throughout the insertion process.

The monitor alerts the operator when a dispensing head is out of components. Each dispensing head includes a refire sensor that causes an automatic head refire whenever a component gap is detected in the input tape. If more than four consecutive components are missing from the tape, the machine stops, allowing the operator to correct the component input. A low part sensor also recognizes a low part condition. The default response is a flashing blue light and audio module activation from the machine light tower.



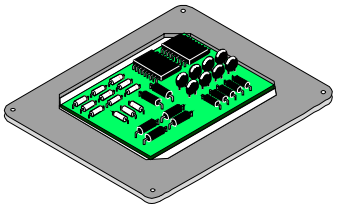
Add-On Component Sequencer Modules

Field retrofit of add-on modules of 20 stations each are available to expand machine capacity to 40, 60, 80, or 100 stations.



Expanded Range Verifier

The Expanded Range Verifier (ERV) provides on-line verification of the component's value, tolerance, or polarity. The ERV is capable of verifying most radial lead components. Test parameters are entered as part of the product (pattern program). The ERV alerts the operator of components failing verification and allows them to be reverified and/or replaced. ERV specifications can be found in the latest version of GS-167.

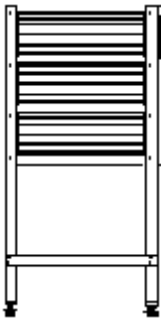


Workboard Holders

Workboard holders are required to accurately secure PC boards to the rotary table during the insertion process when manual PCB load/unload is being considered. Universal provides a wide range of workboard holder products which can be ordered separately or with a new machine purchase.

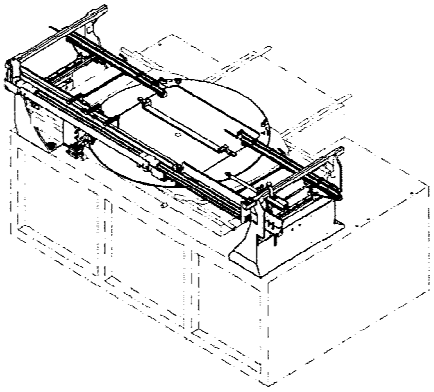
When the machine is equipped with the internal BHS, a workboard holder is not required.

Note: Insertable area may vary depending upon head configuration.



Component Makeup Bins

Component makeup bins store individual components for manual replacement. The bins are individually numbered to correspond to the component dispensing stations.



Board Handling System (BHS)

The BHS transfers PC boards into and out of the insertion area of the machine.

The Board Handling System (BHS) is customer-selectable (factory set) for right-to-left or left-to-right transfer direction.

The fixed front rail provides fast and easy manual width adjustment during PC board changeover.

Host Computer Interface Kit

This kit is used to interface Radial 8XT with a host computer using the SECS/GEM Standard. The Generic Equipment Model (GEM) Standard defines a standard implementation of the SECS II (Semi Equipment Communications Standard 2) communications interface for all semiconductor manufacturing equipment. See SEMI International Standards document E30-93 for details. Note: Requires customer's host computer to be compliant with SECS/GEM standard SEMI E37, HSMS.

CE Non-Pass Through Cover Package

- In normal run mode, front covers open when board is complete to allow PCB unload/load.
- After operator changes the board, a button is pressed to close the covers and reset the interlock and start button is pressed to resume operation.
- The covers may be opened at any time by pressing the stop button then the open cover button.
- The covers may be configured through software to open if an error causes the machine to stop, i.e. missing part or misinsertion.
- Circuitry and software unique to CE NPT cover package improves interlock recovery time after the covers have been opened (interlocks violated) to load/unload the PC board.
- When interlock bypass key is switched to "maintenance mode", air is removed from the cover air cylinders and the covers may be opened and closed manually.
- Compatible with existing "stand alone" workboard holders.

Technical Specifications

Insertion Rate

Up to 21,000 components per hour for single pitched components. Machine options and pattern program may decrease themaximum insertion rate.

Insertion rate is determined by inserting components taped on 12.7 mm or 15 mm pitch into a printed circuit board with up to a maximum of 15.2 mm (0.600") X or Y table moves.

Actual Insertion Rate Per Hour =

$$\frac{(\text{\# of Components Inserted} - 1) \times (3600)}{\text{Time in Seconds}}$$

Determination of Actual Machine Speed

Timing begins as the first component is inserted into the PCB and ends when the last component is inserted. One component is not counted because it does not include component transfer to the insertion head.

Estimate of Machine Speed

Insertion rate will vary from board to board. The following conditions affect insertion rate:

1. Table moves over 15.2 mm (0.600").
2. Proportion of insertions other than 0°, 90°, and 270°.
3. Proportion of single pitch to double pitch taped components. As opposed to single pitch taped components, double pitch taped components (i.e. 10 pin SIPs) require the dispense head to fire twice in order to place the components in the sequencer chain. To consider the effect of double pitch versus single pitch components, refer to the formula below:

$$\frac{(\text{\# of Components Inserted Single Pitch} \times \text{cph}) + (\text{\# of Components Inserted Double Pitch} \times [2/3 \times \text{cph}])}{\text{Total Number of Components}}$$

Total Board Processing Time =

Board transfer time (either automatic or manual) + park-to-park board population time

Insertion Features/Components

Insertion	Insertions at 0° to 360° in 1° increments is possible by rotationg the insertion head, component input at dispensing head, or rotary table.	
Insertion Lead Span	**Dual Span** 2.5 mm and 5.0 mm	**Triple Span** 2.5 mm, 5.0 mm, 7.5 mm
Insertion Density	High insertion density is accomplished under pattern control by utilizing four axis insertion.	
Component Body Diameter	Up to 13.0 mm (0.51")	
Component Types	Radially-taped components within Universal specifications in this GS, including odd form styles such as potentiometers, tact switches, fuse clips, coils, LEDs, SIPs, etc.	

Cut and Clinch

Dual Span	Fourclinches are available: "T-Type", "N-Type" Long Lead, "N-Type" Short Lead, and "N-Type" Standard Lead.
Triple Span	Three clinches are available: "N-Type" Long Lead, "N-Type" Short Lead , and "N-Type" Standard Lead.

Positioning System

Accuracy	±0.05 mm (±0.002")
Repeatability	±0.025 mm (±0.001")
Table Capacity	22.7 kg (50 lbs.) maximum, including workboard holder
Programming Capability	±0.01 mm (metric dimensioning) ±0.001" (inch dimensioning)
Speed	368 mm (14.5") per second:

Machine Dimensions & Weights[1]

(See Appendix for Loader/Unloader configurations)

	Uncrated (no skid or crating material)		**Domestic** (skidded and plastic covering banded over machine)	
	L X D X H[1]	**Weight[1, 2]**	**L X D X H[1]**	**Weight[1, 2]**
Inserter				
W/Automatic Board Handling	1902 x 1588 x 1670 (75 x 63 x 66)	1089 (2400)	2210 x 1830 x 1727 (87 x 72 x 68)	1075 (2365)
W/o Board Handling	1800 x 1588 x 1670 (71 x 63 x 66)	998 (2200)	2210 x 1830 x 1727 (87 x 72 x 68)	1075 (2365)
Verifier/Cutter Station[3]	1067 x 565 x 1156 (42 x 22 x 46)	193 (425)	1397 x 813 x 1270 (55 x 32 x 50)	237 (521)
In-Line Configuration				
First 20 station Sequencer Module	2032 + 181 x 1067 x 1537 (80 + 7 x 42 x 61)	306.17 (675)	2540 x 1575 x 1524 (100 x 62 x 60)	538 (1184)
Each Additional 20 station add-on Sequencer Module	1016 + 181 x 1448 x 1537 (40 + 7 x 57 x 61)	306.17 (675)	1473 x 1575 x 1524 (58 x 62 x 60)	377 (829)
Straight-Back Configuration				
First 20 station Sequencer Module	1478 x 1016 + 180 x 1537 (57 x 40 + 7 x 61)	284 (625)	1473 x 1575 x 1524 (58 x 62 x 60)	377 (829)
Each Additional 20 station add-on Sequencer Module	1478 x 1016 + 180 x 1537 (57 x 40 + 7 x 61)	284 (625)	1473 x 1575 x 1524 (58 x 62 x 60)	377 (829)
Support Items	–	–	1905 x 1067 x 787.4 (75 x 42 x 31)	159 (350)
	Air Crating (partial wood crating)		**Ocean Crating** (full wood crating)	
	L X D X H[1]	**Weight[1, 2]**	**L X D X H[1]**	**Weight[1, 2]**
Inserter				
W/Automatic Board Handling	2235 x 1854 x 1905 (88 x 73 x 75)	1317 (2897)	2235 x 1854 x 1905 (88 x 73 x 75)	1317 (2897)
W/o Board Handling	2235 x 1854 x 1905 (88 x 73 x 75)	1317 (2897)	2235 x 1854 x 1905 (88 x 73 x 75)	1317 (2897)
Verifier/Cutter Station	1422 x 838 x 1346 (56 x 33 x 53)	272 (598)	1422 x 838 x 1346 (56 x 33 x 53)	287 (632)
In-Line configuration				
First 20 station Sequencer Module	2565 x 1600 x 1753 (101 x 63 x 69)	773 (1700)	2565 x 1600 x 1753 (101 x 63 x 69)	734 (1615)
Each Additional 20 station add-on Sequencer Module	1499 x 1600 x 1753 (59 x 63 x 69)	500 (1100)	1499 x 1600 x 1753 (59 x 63 x 69)	500 (1100)

Straight-Back Configuration				
First 20 station Sequencer Module	1499 x 1600 x 1753 (59 x 63 x 69)	500 (1100)	1499 x 1600 x 1753 (59 x 63 x 69)	500 (1100)
Each Additional 20 station add-on Sequencer Module	1499 x 1600 x 1753 (59 x 63 x 69)	500 (1100)	1499 x 1600 x 1753 (59 x 63 x 69)	500 (1100)
Support items	1905 x 1067 x 787.4 (75 x 42 x 31)	268 (589)	1930 x 1245 x 1016 (76 x 49 x 40)	333 (732)

Notes:

1. Measurements and weights are in metric figures; inch and pound equivilents are bracketed. Measurements are rounded to the nearest whole number.
2. Weight varies as a result of pallet construction and moisture content of the wood.

Length is the direction of board flow.

Floor Space	A minimum clear area of one meter (three feet) around the machine perimeter is recommended for machine operation and servicing.
Height to Rotary Table Top	The dimension, 953.5 mm (37.54") measured from the floor to the top of the rotary table must be maintained at installation.

Service Requirements (including Uninterruptable Power Supply)

Electrical (base machine)

Machine is shipped with a power cord from machine to Uninterruptable Power Supply. A mating connector is supplied to attach the user provided power cord to the UPS.

The UPS has an external 5mm ground stud which must be permanently connected to earth/building ground with a 14 AWG or 2.5mm^2 wire that is appropriately protected from mechanical damage.

A circuit breaker is the overcurrent device for both the machine and the UPS. The machine breaker has a short circuit interrupting capacity of 10,000A, and the UPS breaker has a short circuit interrupting capacity of 1000A.

The branch circuit supplying the machine must be protected by an approved 15 amp circuit breaker with a delay suitable for “high inrush current” or “transformer loads.”

Air Consumption - A quick disconnect with a male barbed fitting for 12.7mm (0.50") ID flexible hose is shipped with each machine.

Pneumatic connection located in the back of the machine. 228mm (9") from the right side and 558mm (22") from the floor.

Air Quality - Non-lubricated, dry air, dewpoint must be at 11°C (20°F) below ambient temperature. Dust contamination: particle size of 5.0 microns or smaller. Oil contamination: Lubricant should not exceed 0.08 ppm at 28°C (82°F).

PNEUMATIC REQUIREMENTS		ELECTRICAL REQUIREMENTS				
Minimum Air Flow Requirements Of Machine	**Air Consumption Of Compressor**	**Input Voltage**	**Input Frequency**	**Input Breaker**	**Actual Power Draw Without Loader/Unloader**	**Actual Power Draw With Loader/Unloader**
114 Liters per Minute @6.21 Bar (4.0 CFM @ 90 PSI)	708 Standard Liters per Minute (25.0 SCFM)	180 - 264 Single Phase	47 - 63Hz	15A	1150 VA 5A @ 230v	1725 VA 7.5A @ 230v

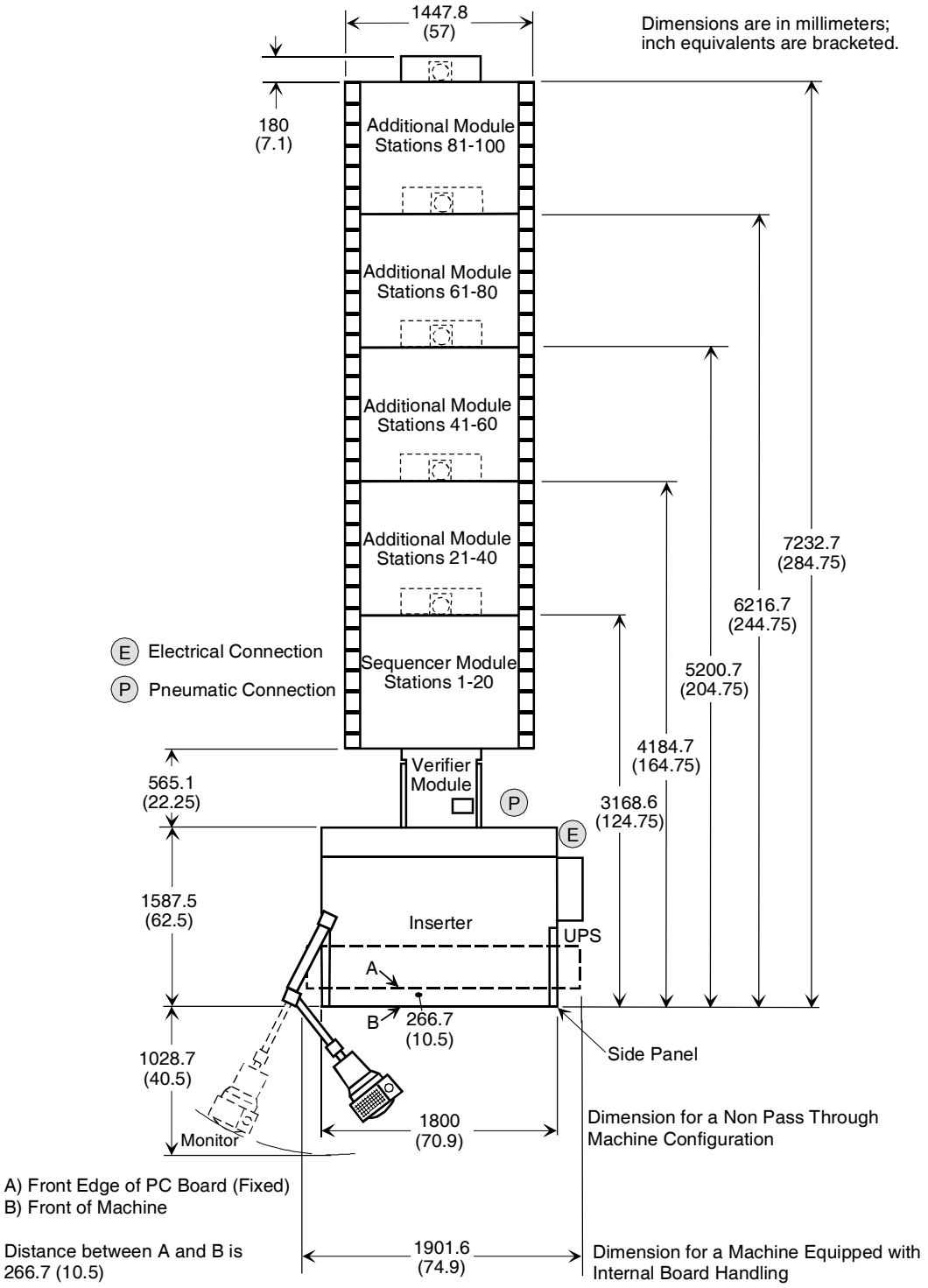
Note:

- Without loader for voltages other than 230 VAC, current is 1150 / (input voltage). Power factor may vary with input voltage.
- With loader for voltages other than 230 VAC, current is 1725 / (input voltage). Power factor may vary with input voltage.
- CFM (Cubic Feet per Minute): Volumetric flow rate at a specified pressure. This is used to describe the air flow requirement. This is used to determine input air line requirements.
- SCFM (Standard Cubic Feet per Minute): Cubic feet of air at 20° C (68° F) at atmospheric pressure. This is used to describe the average air consumption flow requirement needed to determine compressor capacity requirements.

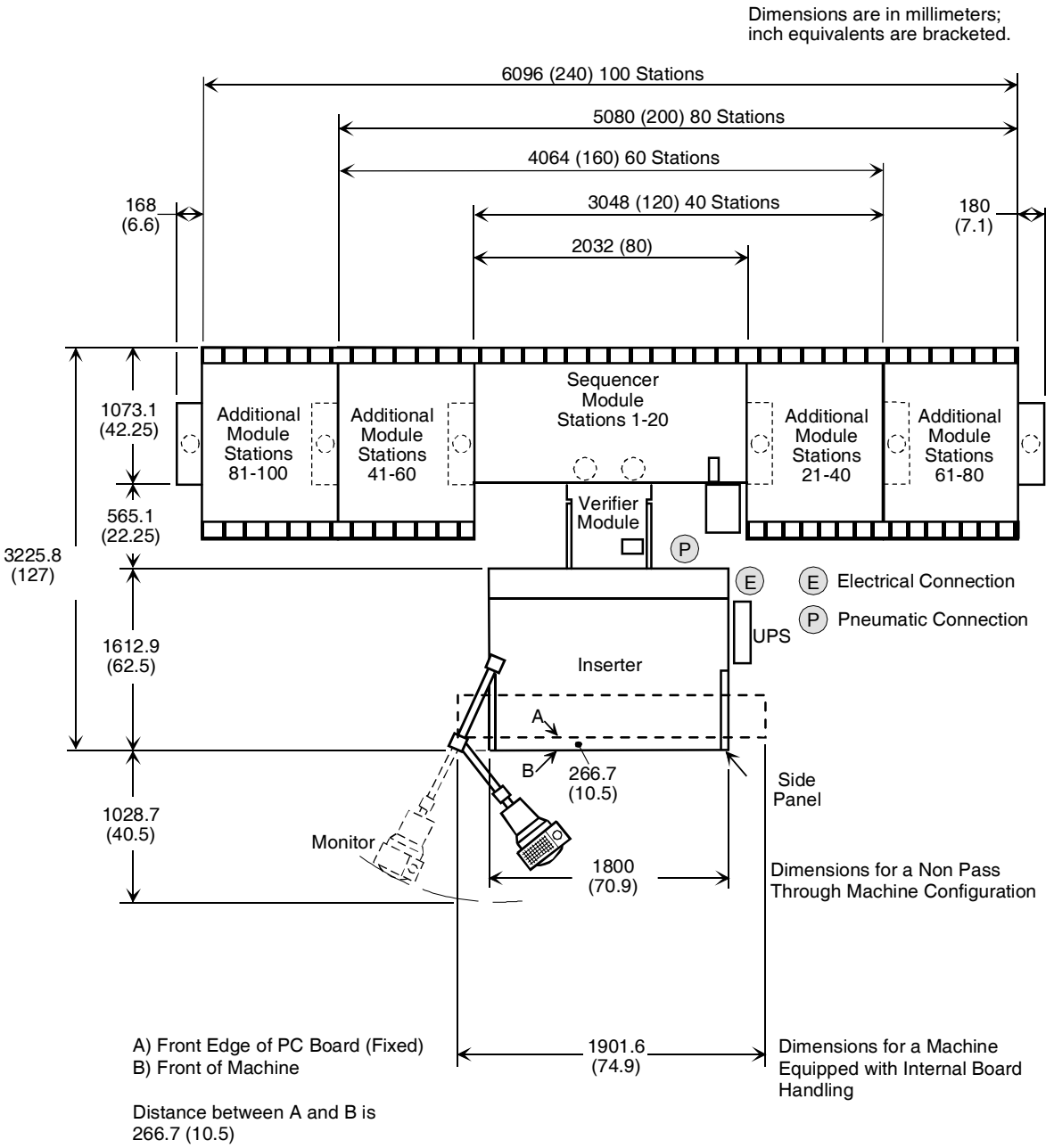
Environmental Requirements

Ambient Temperature	10° C. to 35° C. (50° F. to 95° F.)
Operating Humidity	10% to 90%, non-condensing
Storage Temperature	-25° C. to 55° C. (-13° F. to 131° F.); not exceeding 24 hours up to 70° C. (158° F.). 10% to 95%, non-condensing. Universal provides suitable means to prevent damage from humidity, vibration, stress and shock.
Noise-Level	75 dbA with Pass Through cover package (82 dbA for cover package without Pass Through), in accordance with National Machine Toolbuilders Assoc. Standards.

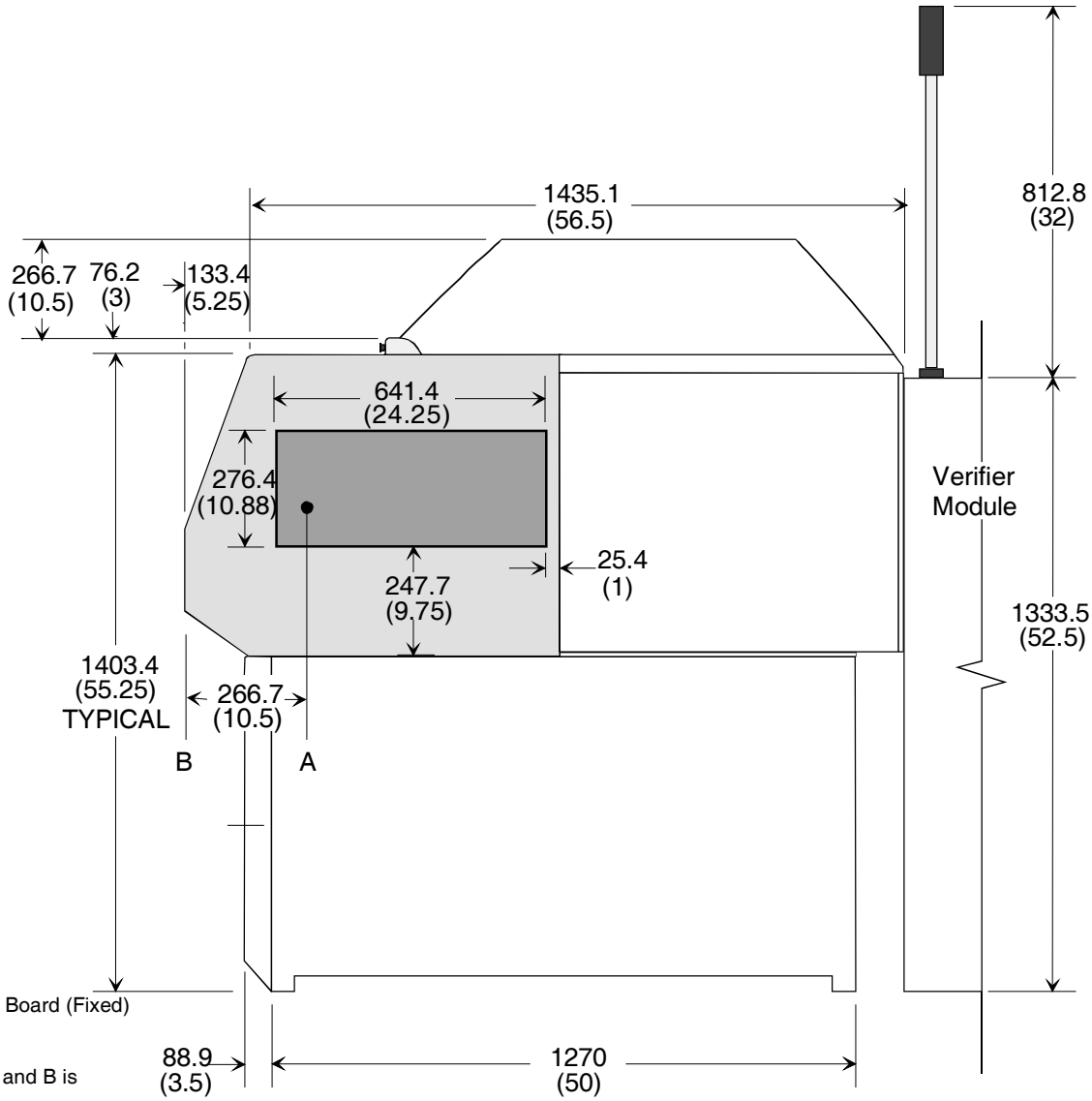
Straight-Back Sequencer Configuration



In-Line Sequencer Configuration



Radial 8XT — Side View



A) Front Edge of PC Board (Fixed)
B) Front of Machine

Distance between A and B is 266.7 (10.5)

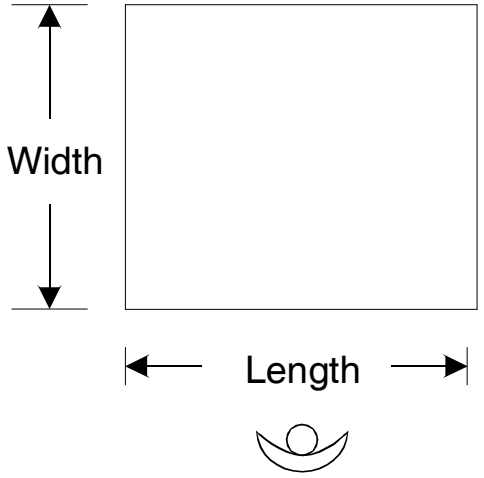
Note: Shaded area and dimensions A&B apply only to pass through machines.

Non Pass Through / Pass Through Configuration

Printed Circuit Board Specifications

PC boards must meet the requirements outlined below.

- Minimum Board Thickness: 0.79 mm (0.0312").
- Maximum Board Thickness: 2.36 mm (0.0937").
- PC board thickness together with the height of a component shall not exceed 25.65m m (1.010").
- Allowable Board Dimensions: See tables below.



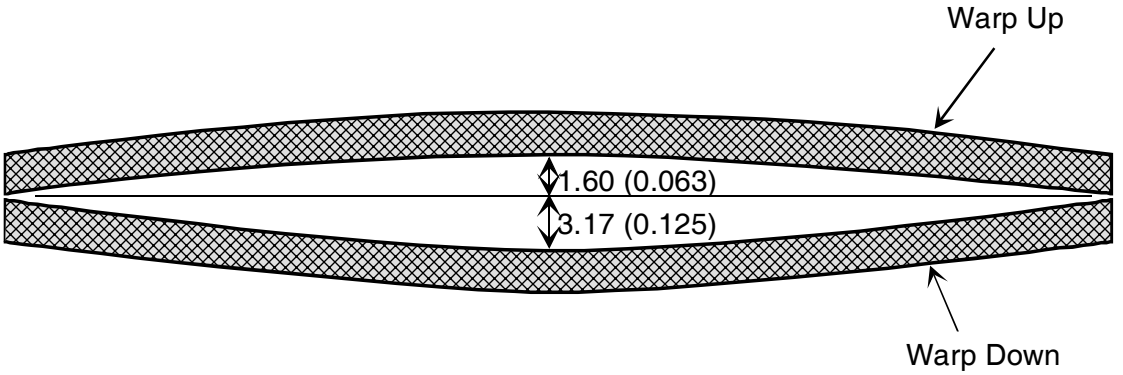
Board Size - Non Board Handling Machine	Length	Width
Maximum	559 mm (22")	470 mm (18.5")
Minimum	51 mm (2")	51 mm (2")
Insertable Area	508 mm (20.0")	470 mm (18.5")

Board Size - Board Handling Machine	Length	Width
Maximum	483 mm (19")	406 mm (16")
Minimum	102 mm (4")	80 mm (3.1")
Insertable Area	483 mm (19.0")	406 mm (16")

- Allowable Board Warpage: See illustration below.

PC boards of varying thickness must not be intermixed. Warpage in excess of the stated specification may adversely affect machine performance.

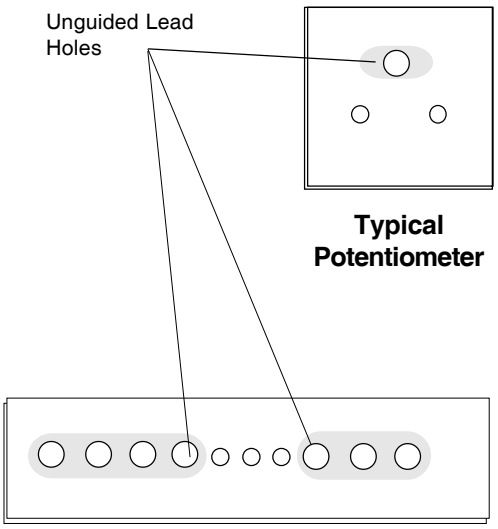
Dimensions are in millimeters;
inch equivalents are bracketed.



Maximum Allowed Warp Up: 0.04 mm/cm, up to 1.60 mm (0.004"/inch, up to 0.063")

Maximum Allowed Warp Down: 0.07 mm/cm, up to 3.17 mm (0.007"/inch, up to 0.125")

Component Lead Hole Specifications



Typical Potentiometer

Typical SIP

Note:
Unguided leads require larger hole-to-lead relationships.

PC boards should be punched for component lead insertion to the following recommended hole diameters.

- HOLE DIAMETER = LEAD MAXIMUM DIAMETER (ϕd for round leads, ϕd_3 for rectangular leads) + 0.483 mm (0.019") ±0.08 mm (0.003")

Hole sizes less than the recommended size may result in a degradation of insertion reliability while holes that are greater than recommended may result in loose components in the printed circuit board.

Unguided leads require larger hole-to-lead relationships. For triangular or in-line layout (such as potentiometers and SIPs), PC boards should be punched for the unguided lead(s) to the following recommended hole diameter.

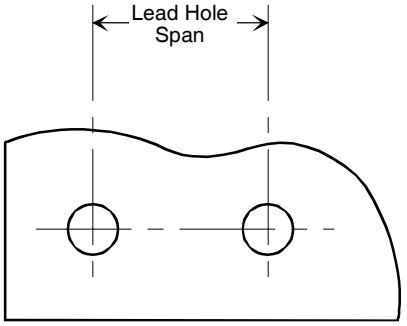
- HOLE DIAMETER = MAXIMUM LEAD DIAMETER + 0.584 mm (0.023") ±0.08 mm (0.003")

Note:
For maximum lead diameter, use ϕd for round leads and ϕd_3 for rectangular leads. (Refer to the notes for "Two-Leaded Component Specifications" for definitions of ϕd and ϕd_3.)

For further considerations and examples of lead-to-hole relationships, see the Cut and Clinch sections of this GS for the particular cut and clinch desired.

Holes used for board error correction should be 1.0 mm + 0.5 mm (0.040" + 0.020"). Plated holes or translucent PCBs may affect performance.

Recommended Lead Hole Span



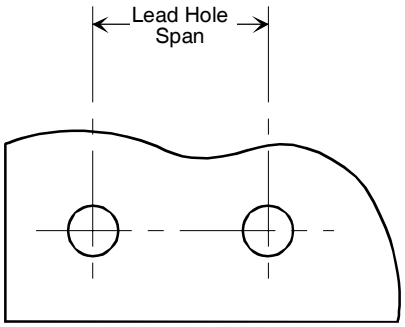
Dual Span Machines

Insertion performance is maximized by considering the jaw tooling design when laying out the PC board hole patterns (the jaw clamps secure the component leads against the fixed surfaces of the jaw guide). In order to achieve the best results, the insertion hole spans in the PC board should be designed at 2.54 mm (0.100") (for 2.5 mm components), one lead diameter plus 4.5 mm (0.177") (for 5 mm components). Use the following table for a reference.

2.5mm		5.0mm	
Lead Diameter	**Recommended Lead Hole Span**	**Lead Diameter**	**Recommended Lead Hole Span**
0.36 mm (0.014")	2.34 mm (0.092")	0.36 mm (0.014")	4.85 mm (0.191")
0.41 mm (0.016")	2.37 mm (0.094")	0.41 mm (0.016")	4.9 mm (0.193")
0.46 mm (0.018")	2.44 mm (0.096")	0.46 mm (0.018")	4.95 mm (0.195")
0.51 mm (0.020")	2.49 mm (0.098")	0.51 mm (0.020")	5.0 mm (0.197")
0.56 mm (0.022")	2.54 mm (0.100")	0.56 mm (0.022")	5.05 mm (0.199")
0.61 mm (0.024")	2.59 mm (0.102")	0.61 mm (0.024")	5.11 mm (0.201")
		0.66 mm (0.026")	5.16 mm (0.203")
		0.71 mm (0.028")	5.21 mm (0.205")

Note:
These dimensions apply only to holes for leads that are captured by the insertion tooling. All remaining holes should be drilled according to component manufacturers' specified spacing requirements.

Recommended Lead Hole Span



Triple Span Machines

Insertion performance is maximized by considering the jaw tooling design when laying out the PC board hole patterns (the jaw clamps secure the component leads against the fixed surfaces of the jaw guide).

For best results, the insertion hole spans in the PC board should be designed as follows:

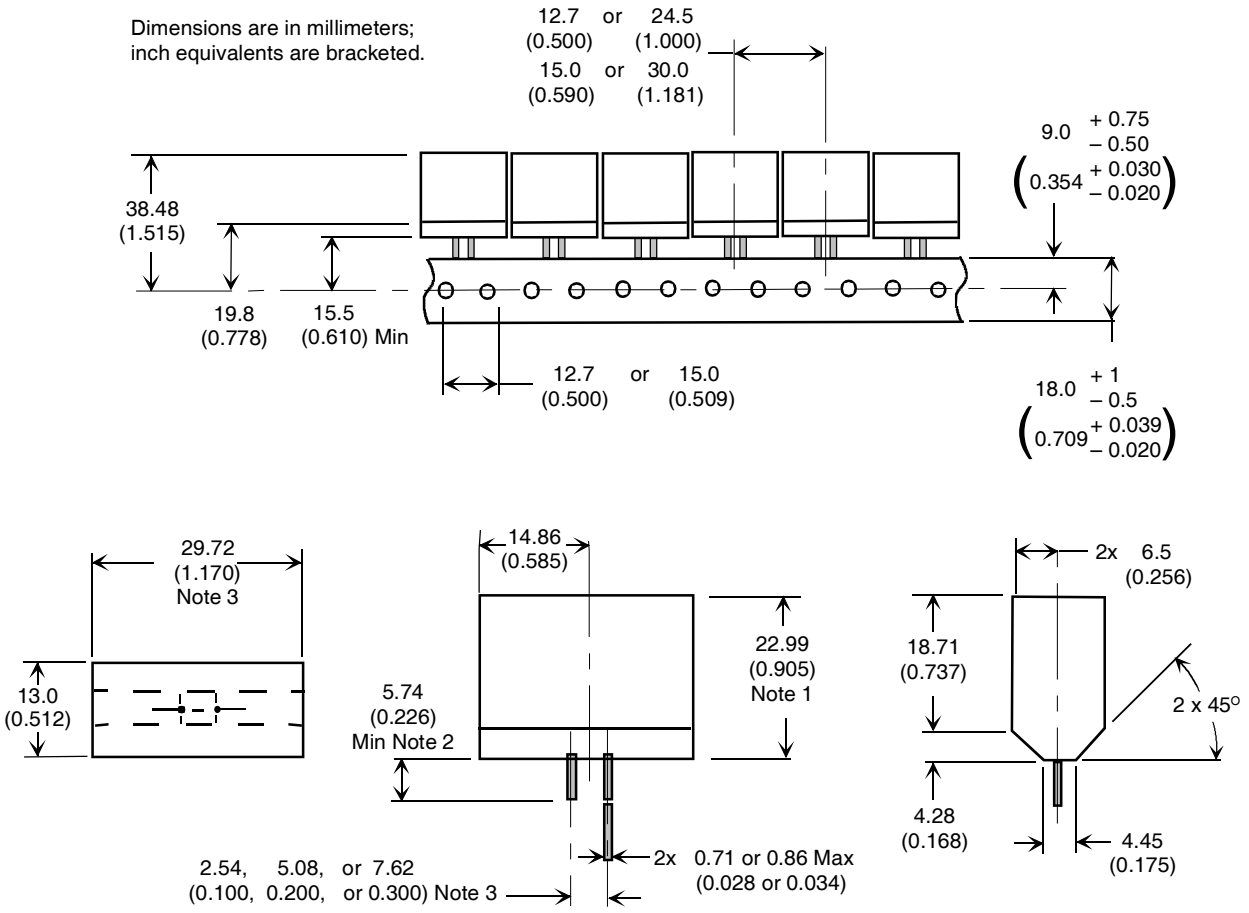
- 2.54 mm (0.100") for 2.5 mm components
- one lead diameter + 4.5 mm (0.177") for 5.0 mm components
- one lead diameter + 7.04 mm (0.277") for 7.5 mm components

Use the following table for a reference.

Lead Diameter	Recommended Lead Hole Span	Lead Diameter	Recommended Lead Hole Span
2.5mm		**5mm**	
0.36 mm (0.014")	2.54 mm (0.100")	0.36 mm (0.014")	4.85 mm (0.191")
0.41 mm (0.016")	2.54 mm (0.100")	0.41 mm (0.016")	4.90 mm (0.193")
0.46 mm (0.018")	2.54 mm (0.100")	0.46 mm (0.018")	4.95 mm (0.195")
0.51 mm (0.020")	2.54 mm (0.100")	0.51 mm (0.020")	5.00 mm (0.197")
0.56 mm (0.022")	2.54 mm (0.100")	0.56 mm (0.022")	5.05 mm (0.199")
0.61 mm (0.024")	2.54 mm (0.100")	0.61 mm (0.024")	5.11 mm (0.201")
0.66 mm (0.026")	2.54 mm (0.100")	0.66 mm (0.026")	5.16 mm (0.203")
0.71 mm (0.028")	2.54 mm (0.100")	0.71 mm (0.028")	5.21 mm (0.205")
0.76 mm (0.030")	2.54 mm (0.100")	0.76 mm (0.030")	5.26 mm (0.207")
0.81 mm (0.032")	2.54 mm (0.100")	0.81 mm (0.032")	5.31 mm (0.209")
0.86 mm (0.034")	2.54 mm (0.100")	0.86 mm (0.034")	5.36 mm (0.211")
7.5mm			
0.36 mm (0.014")	7.39 mm (0.291")		
0.41 mm (0.016")	7.44 mm (0.293")		
0.46 mm (0.018")	7.49 mm (0.295")		
0.51 mm (0.020")	7.54 mm (0.297")		
0.56 mm (0.022")	7.59 mm (0.299")		
0.61 mm (0.024")	7.65 mm (0.301")		
0.66 mm (0.026")	7.70 mm (0.303")		
0.71 mm (0.028")	7.75 mm (0.305")		
0.76 mm (0.030")	7.80 mm (0.307")		
0.81 mm (0.032")	7.85 mm (0.309")		
0.86 mm (0.034")	7.90 mm (0.311")		

Note:
These dimensions apply only to holes for leads that are captured by the insertion tooling. All remaining holes should be drilled according to component manufacturers' specified spacing requirements.

Maximum Size Component



Note:

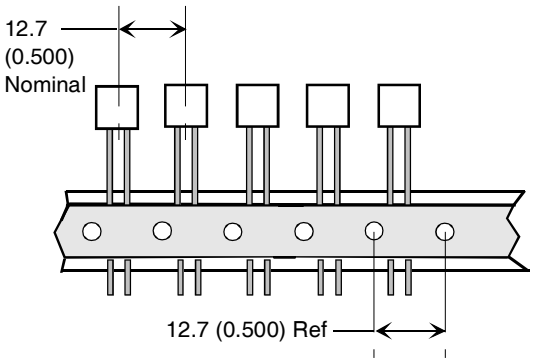
1. Maximum height with or without standoffs.
2. Minimum straight lead length below component body or standoff.
3. Head tooling centerline should be considered when handling component bodies that are not centered about the lead span.

This illustration represents the maximum parameters within which a component must fit to be handled by the insertion head on the Radial 8XT.

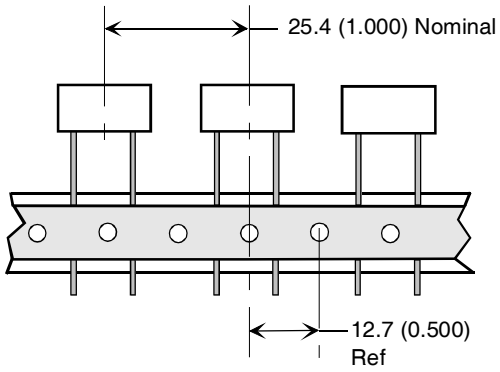
Component Spacing for 12.7 mm and 15.0 mm (0.500" and 0.590") Pitch Tape

Dimensions are in millimeters;
inch equivalents are bracketed.

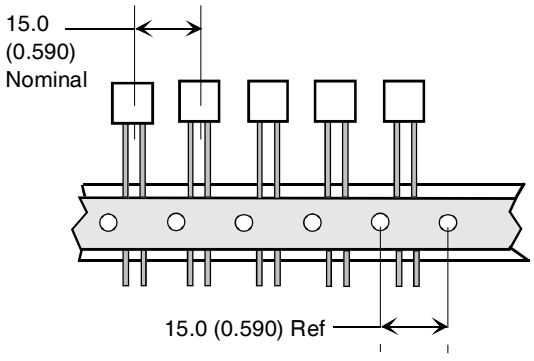
Single Pitch
Component Taping

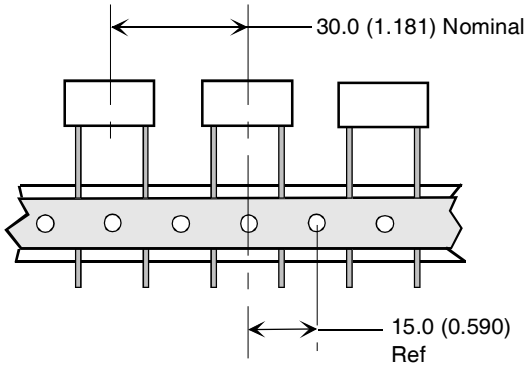


Double Pitch
Component Taping



Component Spacing for 12.7 (0.500) Pitch Tape

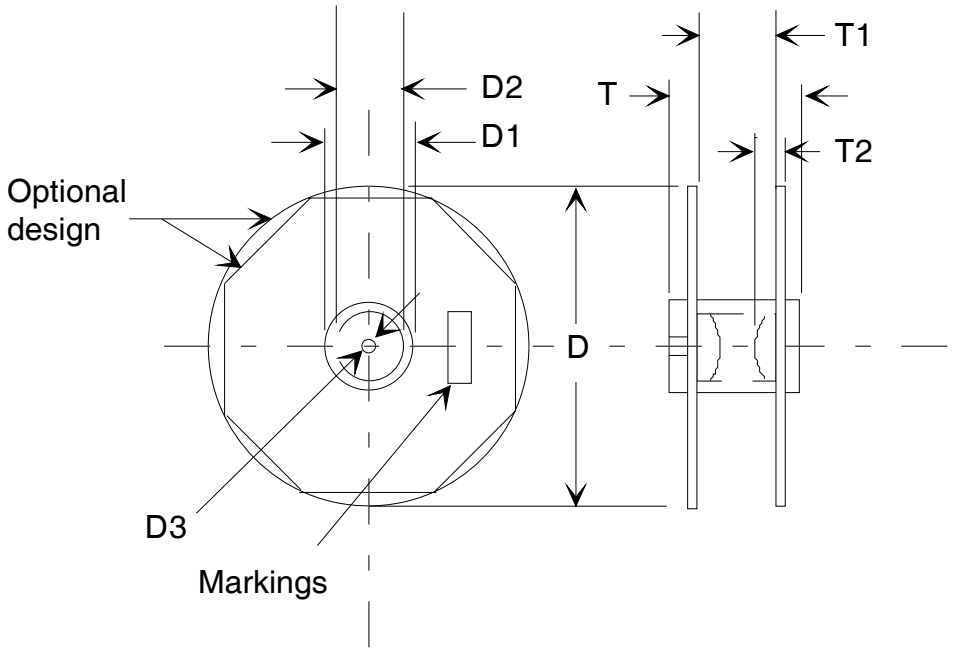




Component Spacing for 15.0 (0.590) Pitch Tape

Radial Lead Taped Component Packaging Specifications

Applicable to reel, cassette and ammo-pack (fold-pack) containers for radial lead taped components. A tape trailer having at least 3 feed holes is required at the end of the tape to feed the last component into the dispensing head.



SYMBOL	ITEM	SPECIFICATION			
		MINIMUM		MAXIMUM	
		MM	INCH	MM	INCH
D	REEL DIAMETER	76.2	3.0	360	14.0
D1	CORE DIAMETER	34.9	1.4	102	4.0
D2	HUB RECESS INSIDE DIAMETER	28.6	1.12	86.4	3.4
D3	ARBOR HOLE DIAMETER	13.8	0.54	38.1	1.5
T	OVERALL REEL THICKNESS	-	-	63.5	2.5
T1	INSIDE REEL FLANGE THICKNESS	30	1.2	50	2.0
T2	HUB RECESS DEPTH	9.5	0.374	-	-

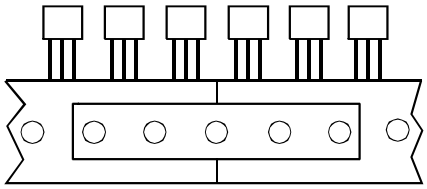
Notes:

1. Taped components shall be loaded in a reel, cassette, or ammo-pack type container. Maximum package outside dimensions shown for reels apply equally to the other package types.
2. No more than 3 consecutive missing components are permitted.
3. Polarized components will be oriented in one direction on the input reel, cassette or ammo-pack container.
4. Optional 500 mm (19.6") diameter reel holders are available.

Taped Component Removal Pull Testing

The taped components shall unwind (reel and cassette) or unfold (ammo-pack) with a force not to exceed 5 Newtons (17.9 oz.). Pull test shall be applied as illustrated.

Input Tape Splicing



Component may be spliced with an acceptable splicing tape. Universal splicing tape is recommended.

Splices must not interfere with tape feed holes and overall tape thickness may not exceed 1.5 mm (0.059").

Maximum Reel Weight

To handle reels of components in excess of 1.8 kg (4 lbs.), consult a Universal Sales Engineer.

Dual Span Specific Technical Specifications (2.5mm/5.0mm)

- Component Input/Taping Specifications
- Cut & Clinch
- Insertion Head Footprints

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Component Input/Taping Specifications

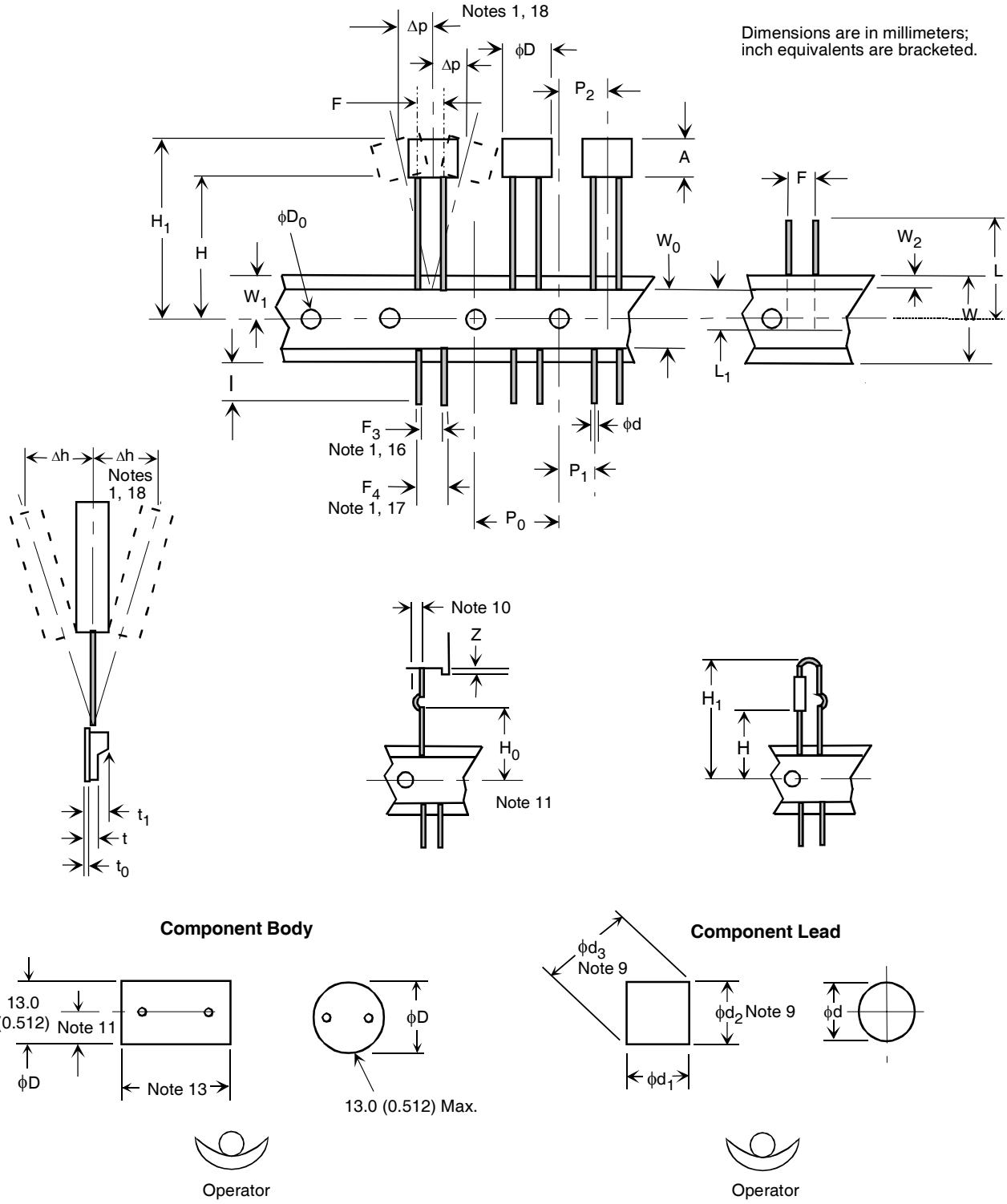
Components taped in a radial format meeting the specifications contained in this GS are approved to be used in the Radial 8XT.

Most specifications in this GS are based on EIA-468, "Lead Taping of Components in the Radial Configuration for Automatic Handling,".

Lead spans of 2.5 mm or 5.0 mm on 12.7 mm or 15.0 mm tape pitch are standard.

When radially taped components fall outside of Universal specifications, consult a Universal Sales Engineer.

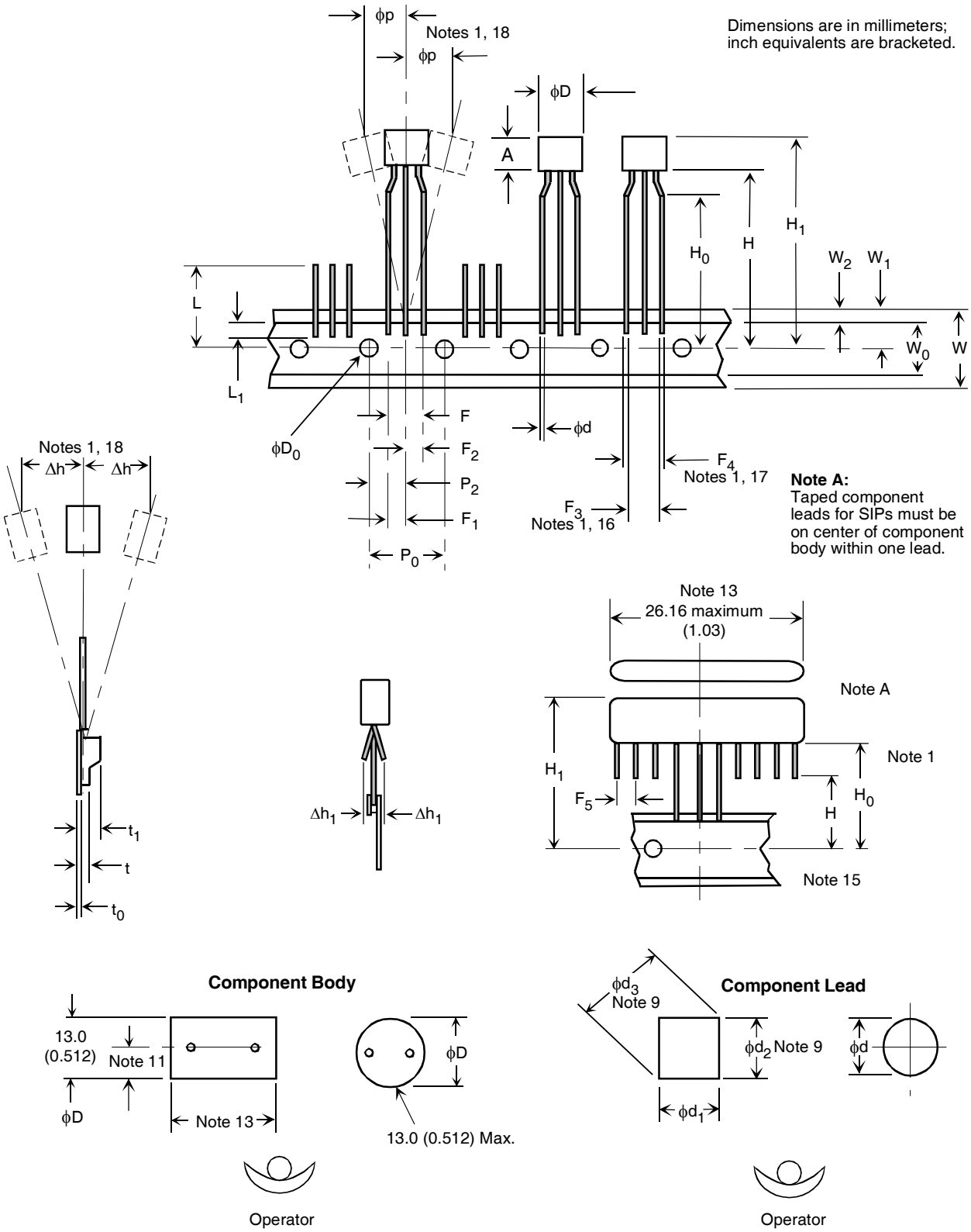
Two-Leaded Components



TWO-LEADED COMPONENT SPECIFICATIONS							
			Minimum		Maximum		
Symbol	Item		mm	inch	mm	inch	Notes
A	Component Body Height		0.36	0.014	23.0	0.906	
ϕD_0	Feed Hole Diameter		3.7	0.146	4.3	0.169	
ϕd	Lead Diameter (Round)	5.0 mm	0.36	0.014	0.71	0.028	12, 22
		2.5 mm	0.36	0.014	0.61	0.024	12, 22
ϕD	Component Body Diameter		N/A	N/A	13.0	0.512	19
ϕd_1	Lead Size (Rectangular)	5.0 mm	0.28	0.011	0.66	0.026	9, 12, 22
		2.5 mm	0.28	0.011	0.50	0.020	9, 12, 22
ϕd_2	Lead Size (Rectangular)	5.0 mm	0.28	0.011	0.66	0.026	9, 12, 22
		2.5 mm	0.28	0.011	0.50	0.020	9, 12, 22
ϕd_3	Lead Across (Diagonal)		N/A	N/A	0.71	0.028	9,12, 22
F	Component Lead Span	5.0 mm	4.88	0.192	5.69	0.224	1, 5
		2.5 mm	2.34	0.092	3.15	0.124	1, 5
F_1, F_2	Component Lead Pitch*		N/A	N/A	N/A	N/A	
F_3	Minimum Inner Spacing Between Leads	5.0 mm	4.34	0.171	N/A	N/A	1, 5, 16
		2.5 mm	1.80	0.071	N/A	N/A	1, 5, 16
F_4	Maximum Outer Spacing	5.0 mm	N/A	N/A	6.22	0.245	
		2.5 mm			3.68	0.145	
F_5	Lead Pitch		2.4	0.096	2.6	0.104	
H_0	Height of Seating Plane		15.5	0.610	22.5	0.886	
H	Feed Hole to Bottom of Component		15.5	0.610	22.5	0.886	11, 20
H_1	Component Height		15.85	0.624	38.5	1.515	14
Δh	Front-to-Rear Deflection		0.0	0.000	1.0	0.039	1, 18
Δh_1	Lead Deflection		N/A	N/A	0.1	0.004	
I	Lead Protrusion		0.0	0.000	1.0	0.039	
L	Lead Length After Component Removal		8.51	0.335	11.2	0.441	3
L_1	Lead Wire Enclosure		2.49	0.098	18.31	0.721	
P_0	Feed Hole Pitch		12.4	0.488	13.0	0.512	4
P_1	Lead Location	5.0 mm	3.10	0.122	4.52	0.178	5
		2.5 mm	4.37	0.172	5.79	0.228	5
P_2	Ordinate To Component Center		5.64	0.222	7.06	0.278	5
Δ_P	Deflection Left or Right		00	0.000	1.3	0.051	1, 18
t	Overall Tape Thickness		0.51	0.020	0.90	0.035	6
t_0	Carrier Tape Thickness		0.38	0.015	0.69	0.027	
t_1	Total Taped Package Thickness		0.86	0.034	1.50	0.059	6
W	Tape Width		17.5	0.689	19.0	0.748	7
W_0	Adhesive Tape Width		5.50	0.216	19.0	0.748	7
W_1	Feed Hole Location		8.5	0.335	9.75	0.384	
W_2	Adhesive Tape Position		0.0	0.000	6.0	0.236	7
Z	Standoff Extensions		0.0	0.000	1.0	0.039	

* Applies to three-leaded components only.

Three-Leaded Components



THREE-LEADED COMPONENT SPECIFICATIONS							
			Minimum		Maximum		
Symbol	Item		mm	inch	mm	inch	Notes
A	Component Body Height		0.36	0.014	23.0	0.906	
ϕD_0	Feed Hole Diameter		3.7	0.146	4.3	0.169	
ϕd	Lead Diameter (Round)	5.0 mm	0.36	0.014	0.61	0.024	9
		2.5 mm	N/A	N/A	N/A	N/A	
ϕD	Component Body Diameter		N/A	N/A	13.0	0.512	1
ϕd_1	Lead Size (Rectangular)	5.0 mm	0.28	0.011	0.50	0.020	22
		2.5 mm	N/A	N/A	N/A	N/A	22
ϕd_2	Lead Size (Rectangular)	5.0 mm	0.28	0.011	0.50	0.20	22
		2.5 mm	N/A	N/A	N/A	N/A	22
ϕd_3	Lead Across (Diagonal)		N/A	N/A	0.71	0.028	9, 12, 22
F	Component Lead Span	5.0 mm	4.88	0.192	5.69	0.224	1, 5
		2.5 mm	2.34	0.092	3.15	0.124	
F_1, F_2	Component Lead Pitch		2.4	0.094	2.9	0.114	1
F_3	Minimum Inner Spacing Between Leads	5.0 mm	4.34	0.171	N/A	N/A	1, 5, 16
		2.5 mm	1.80	0.071	N/A	N/A	
F_4	Maximum Outer Spacing	5.0 mm	N/A	N/A	6.22	0.245	
		2.5 mm			3.68	0.145	
F_5	Lead Pitch		2.4	0.096	2.6	0.104	
H_0	Height of Seating Plane		15.5	0.610	22.5	0.886	
H	Feed Hole to Bottom of Component		15.5	0.610	22.5	0.886	11, 20
H_1	Component Height		15.85	0.624	38.5	1.515	14
Δh	Front-to-Rear Deflection		0.0	0.000	1.0	0.039	1
Δh_1	Lead Deflection		N/A	N/A	0.1	0.004	
I	Lead Protrusion		0.0	0.000	1.0	0.039	
L	Lead Length After Component Removal		8.51	0.335	11.2	0.441	3
L_1	Lead Wire Enclosure		2.49	0.098	18.31	0.721	
P_0	Feed Hole Pitch		12.4	0.488	13.0	0.512	4
P_1	Lead Location	5.0 mm	N/A	N/A	N/A	N/A	
		2.5 mm	N/A	N/A	N/A	N/A	
P_2	Ordinate to Component Center		5.95	0.234	6.75	0.266	5
Δp	Deflection Left or Right		0.0	0.000	1.3	0.051	1
t	Overall Tape Thickness		0.51	0.020	0.89	0.035	6
t_0	Carrier Tape Thickness		0.38	0.015	0.69	0.027	
t_1	Total Taped Package Thickness		0.86	0.034	1.50	0.059	6
W	Tape Width		17.5	0.689	19.0	0.748	7
W_0	Adhesive Tape Width		5.50	0.216	19.0	0.748	7
W_1	Feed Hole Location		8.5	0.335	9.75	0.384	
W_2	Adhesive Tape Position		0.0	0.000	6.0	0.236	7
Z	Standoff Extensions		0.0	0.000	1.0	0.039	

NOTES

1. Maximum alignment deviation or parallelism between leads shall not be greater than 0.20 mm (0.008"). This dimension also applies to the component leads after the cardboard has been removed and to all untaped leads.
2. The distance between the tape feed hole and the bottom of the component, and the distance between the tape feed hole and the leads standoff form, shall be equal within 1.0 mm (0.039").
3. When defective components are clipped from the carrier tape, the remaining protrusion of the leads shall not exceed W_1 + 1.0 mm (W_1 + 0.039").
4. Maximum cumulative variation between tape feed holes shall not exceed +0.5 mm (+0.020") over four pitches.
5. P_1 and F are measured at the lead egress from the carrier tape on the component side (P_1 shall not deviate more than +/- 0.13 mm (0.005") on the same component reel). P_2 is measured at the seating plane.
6. Overall tape package thickness (t_1), including component leads and tape splices, shall not exceed 1.5 mm (0.059").
7. Hold-down tape not to extend beyond the edge(s) of the carrier tape and there shall not be exposure of the adhesive.
8. For components with standoffs, the dimension is measured from the centerline of the feed hole to the inside radius of the form.
9. Minimum/maximum conditions applying to square and rectangular leads are measured on the diagonal ($Ød_3$). The value of $Ød_3$ must be greater than 0.38mm (0.015") and less than 0.86 mm (0.034"). To calculate the diameter of square or rectangular component leads, apply the following formulas:

a. For 5.0mm

$$0.011 < Ød_2 < 0.026$$
$$0.011 < Ød_1 < 0.026$$

$$Ød_3 = Ød_2^2 + Ød_1^2 < 0.028$$

b. For 2.5 mm

$$0.014 < Ød_2 < 0.020$$
$$0.014 < Ød_1 < 0.020$$

$$Ød_3 = \sqrt{Ød_2^2 + Ød_1^2} < 0.024$$

10. Dimension to be 0.38 mm (0.015") larger than hole diameter in the board.
11. If leads are off center of component body, effective ØD dimension = 2x distance from center line of component leads to furthermost edge of component body.
12. Running steel leads with 0.64 mm (0.025") diameter will decrease clinch tooling life.
13. Parts longer than 12.39 mm (0.488"), for example, SIP type components, must be taped 25.4 mm (1") on center. Parts taped in this manner result in an increase in transfer time from dispenser head to carrier clip.

NOTES

14. The distance between the bottom of the guide jaw to bottom of the pusher tip when in full up position is 30.73 mm (1.210"). Full downward travel of the insertion pusher extends to surface of printed circuit board or top of component, whichever is greater.
15. Dimension applies to untaped leads.
16. F_3 dimension is designed to limit the minimum lead span of taped components.
17. F_4 dimension is designed to limit the maximum lead span of the taped component.
18. Component deflection (Δh, Δp) is measured from the centerline of the component at the center top of the component.
19. ØD max is 13.0 mm.
20. Minimum H dimension increases with body diameter. See below. Maximum H dimension is not affected.

Dimensions are in millimeters;
inch equivalents are bracketed.

13.0mm Tooling Style	
ϕD round or rectangle	H Minimum
6.15 (0.242)	15.5 (0.610)
7.0 (0.276)	16.0 (0.630)
8.0 (0.315)	16.5 (0.650)
9.0 (0.354)	17.0 (0.669)
10.0 (0.394)	17.5 (0.689)
11.0 (0.433)	18.0 (0.709)
12.0 (0.472)	18.5 (0.728)
13.0 (0.512)	19.0 (0.748)

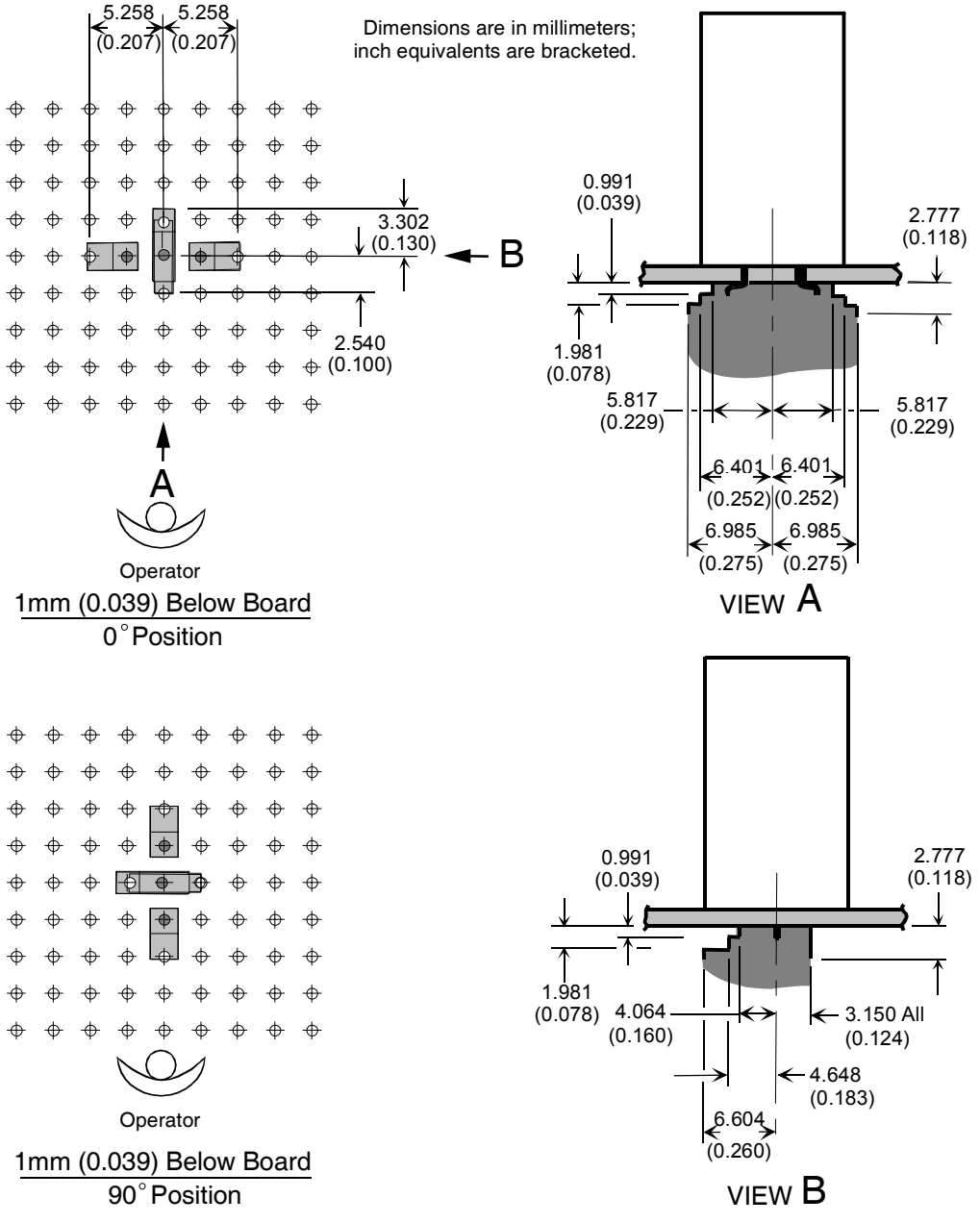
21. Leads cannot be formed outward more than 1.0 mm (0.039") within the carrier tape. There is no limit on inward formation within the carrier tape.
22. Lead specifications contained in this GS apply to lead size and geometry. Lead material as well as lead finish and coating may affect the ability of a component to be successfully processed using automatic insertion equipment.
23. 15mm pitch - Notes and dimensions on these pages apply to 12.7mm pitch components. Similar dimensions apply to 15mm pitch components.

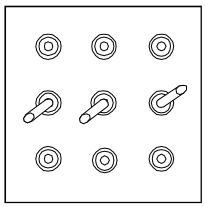
Cut and Clinch Footprints

Cut and Clinch, "T-Type"

The T-type cut and clinch can cut and clinch two- or three-leaded devices at 5.0 mm lead span. The cut and clinch footprint is shown below.

"T-Type" Cut and Clinch Footprint
(5mm and Three-Leaded Devices Only)
Holes Represent PC Board Holes at 2.54 mm (0.100") Spacing

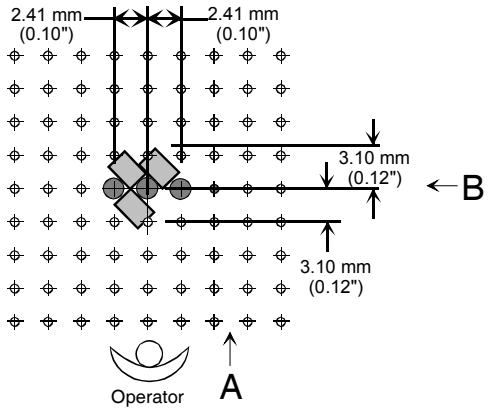




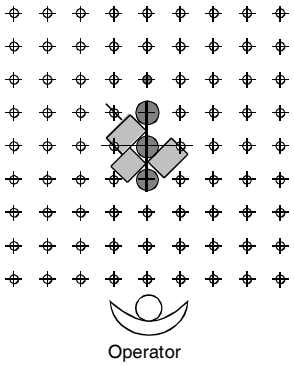
Cut and Clinch, "N-Type," Long Lead

The N-type cut and clinch can cut and clinch 2- and 3-leaded components (2.5 mm/5.0 mm, or 5.0 mm-only). The cut and clinch footprint and recommended clearances are shown below.

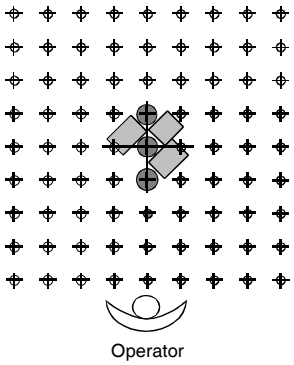
Footprint and Clearances for "N-Type" Long Lead Cut and Clinch Holes Represent PC Board Holes at 2.54 mm (0.100") Spacing



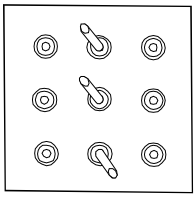
1mm (0.039") Below Board
0° Position



1mm (0.039") Below Board
90° Position Right



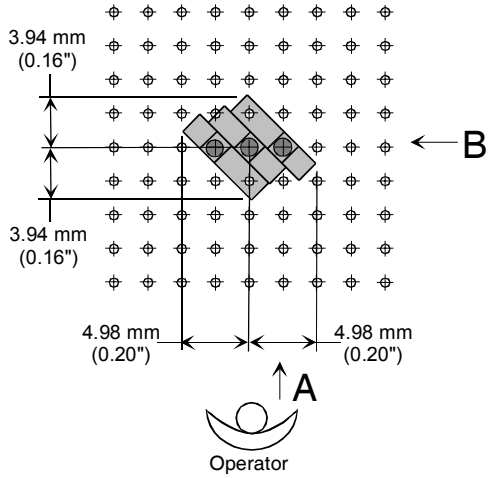
1mm (0.039") Below Board
270° Position Left



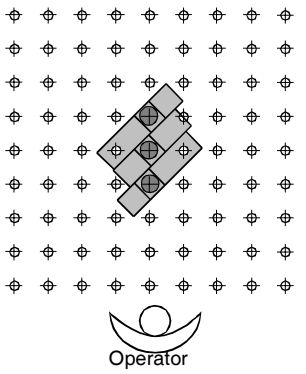
Cut and Clinch, "N-Type," Short Lead

The N-type cut and clinch can cut and clinch 2- and 3-leaded components (2.5 mm/5.0 mm, or 5.0 mm-only). The cut and clinch footprint and recommended clearances are shown below.

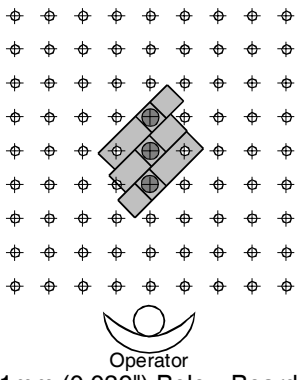
Footprint and Clearances for "N-Type" Short Lead Cut and Clinch
Holes Represent PC Board Holes at 2.54 mm (0.100") Spacing



1mm (0.039") Below Board
0° Position



1mm (0.039") Below Board
270° Position Left

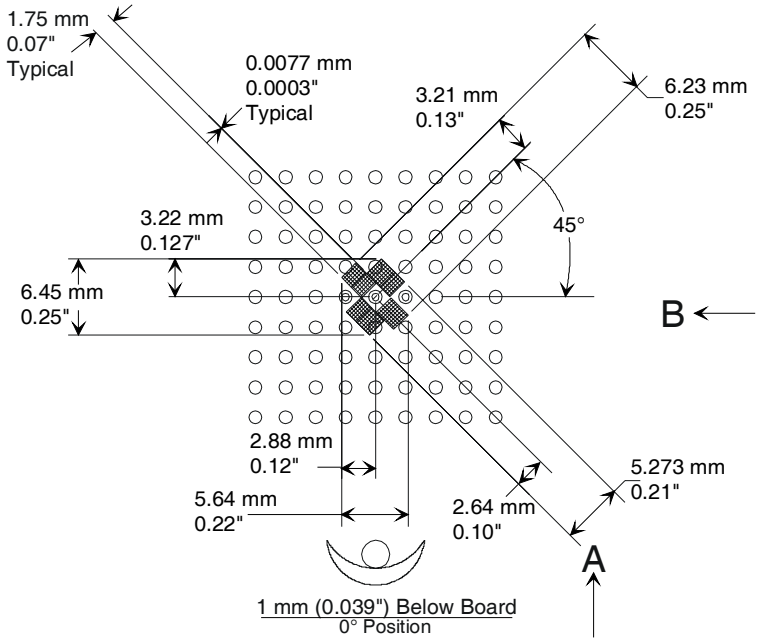


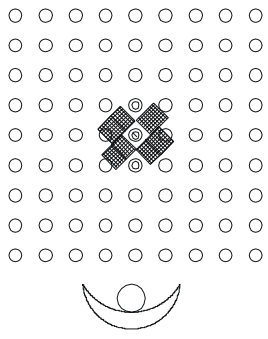
1mm (0.039") Below Board
90° Position Right

Cut and Clinch, "N-Type," Standard Lead

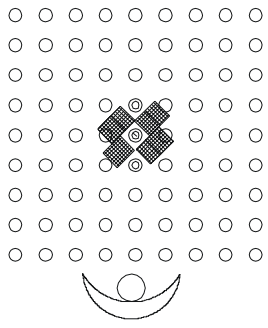
The N-type cut and clinch can cut and clinch 2- and 3-leaded components (2.5 mm/5.0 mm, or 5.0 mm-only). The cut and clinch footprint and recommended clearances are shown below.

Footprint and Clearances for "N-Type" Standard Lead Cut and Clinch Holes Represent PC Board Holes at 2.54 mm (0.100") Spacing



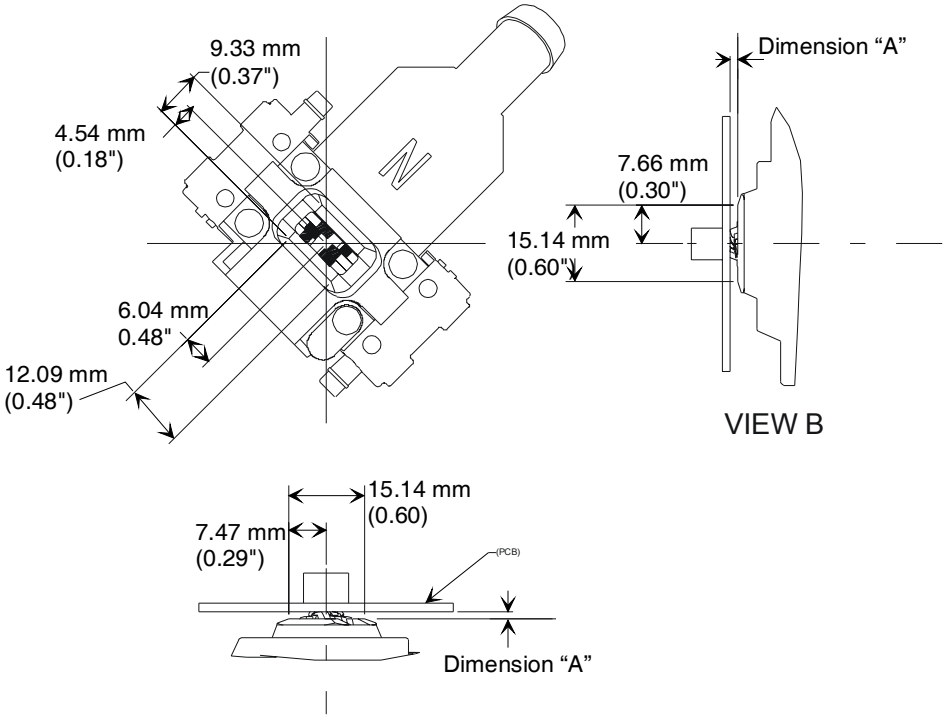


1 mm (0.039") Below Board
90° Position Left



1 mm (0.039") Below Board
90° Position Right

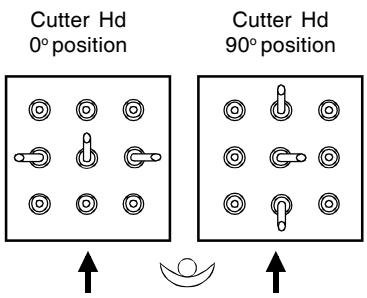
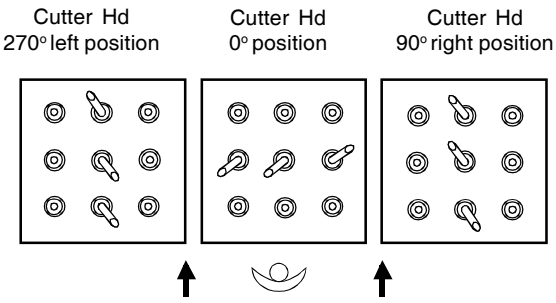
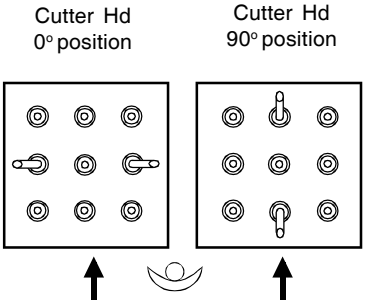
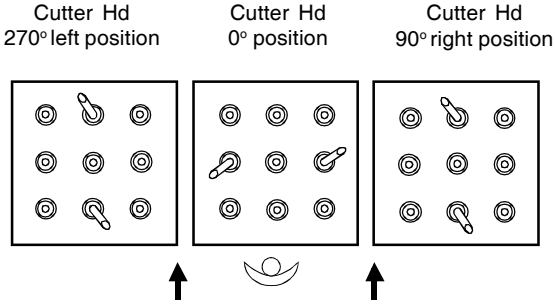
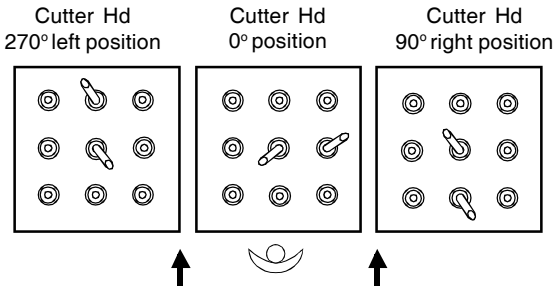
Below Board Clearance, “N-Type,” Dual Span Clinch



CLINCH STYLE	DIMENSION "A"
SHORT LEAD N	1.86 mm (0.07")
STANDARD LEAD N	1.48 mm (0.06")
LONG LEAD N	1.74 mm (0.07")

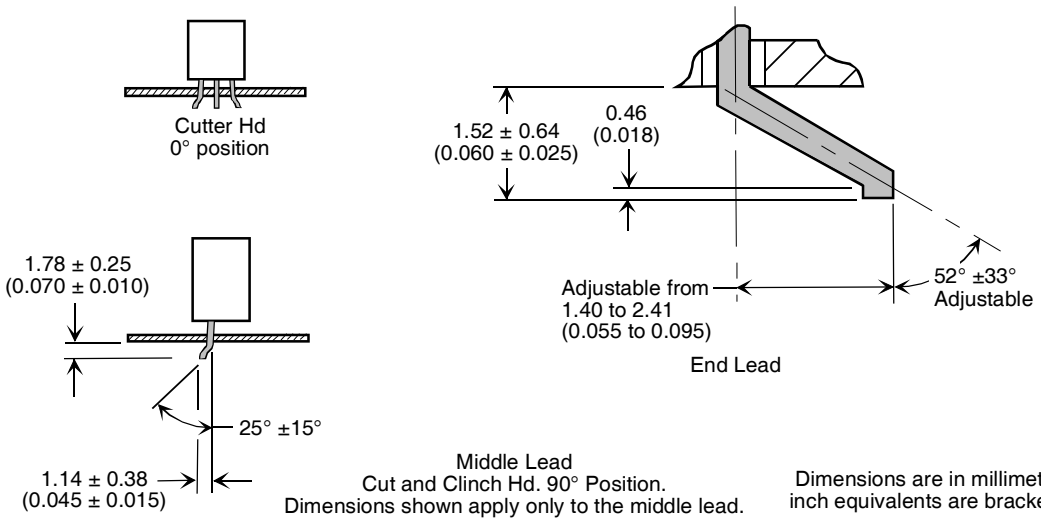
Cut and Clinch Specifications

The cut and clinch tooling matrix that follows is provided as a comparison of current standard Universal cut and clinch tooling. Compared are cut and clinch tooling patterns as viewed from the underside of the printed circuit board. Parameters are based on theoretical values. Cut and Clinch tooling parameters shown are examples for reference only.

	Tooling Pattern as Viewed from Underside of PC Board	
	"T-Type" (5.0 mm) Dimensions shown reflect factory setup dimensions and will vary with lead diameter, materials, hole diameter, spacing, and specific setup requirements.	**"N-Type"** **Long, Short, and Standard Lead** **(2.5 mm/5.0 mm)**
5.0 mm, 3-Lead		
5.0 mm, 2-Lead		
2.5 mm, 2-Lead	NOT APPLICABLE	

Note:
1. Lead angles are measured from the vertical position.

"T-Type" (5.0 mm)



Middle Lead
Cut and Clinch Hd. 90° Position.
Dimensions shown apply only to the middle lead.

Dimensions are in millimeters;
inch equivalents are bracketed.

Note:
Specifications for this cut and clinch (lead angles, lengths and heights) vary based on PC board hole diameters, component lead diameters, component lead material composition and component lead shape (round, square and flat).

Cut and Clinch Lead Dimensions

“N-Type” Long Lead (2.5 mm/5.0 mm)

"A" Lead Angle approximately 55°

"B" Lead Length 1.52 mm ± 0.38 mm
(0.060 ± 0.015")

"C" Lead Height 1.07 mm ± 0.33 mm
(0.042 ± 0.013")

“N-Type” Short Lead (2.5 mm/5.0 mm)

"A" Lead Angle approximately 57°

"B" Lead Length 1.27 mm ± 0.38 mm
(0.050" ± 0.015")

"C" Lead Height 0.81 mm ±0.25 mm
(0.032" ± 0.010")

“N-Type” Standard Lead (2.5 mm/5.0 mm)

"A" Lead Angle approximately 57°

"B" Lead Length 1.4 mm ± 0.38 mm
(0.055 ± 0.015")

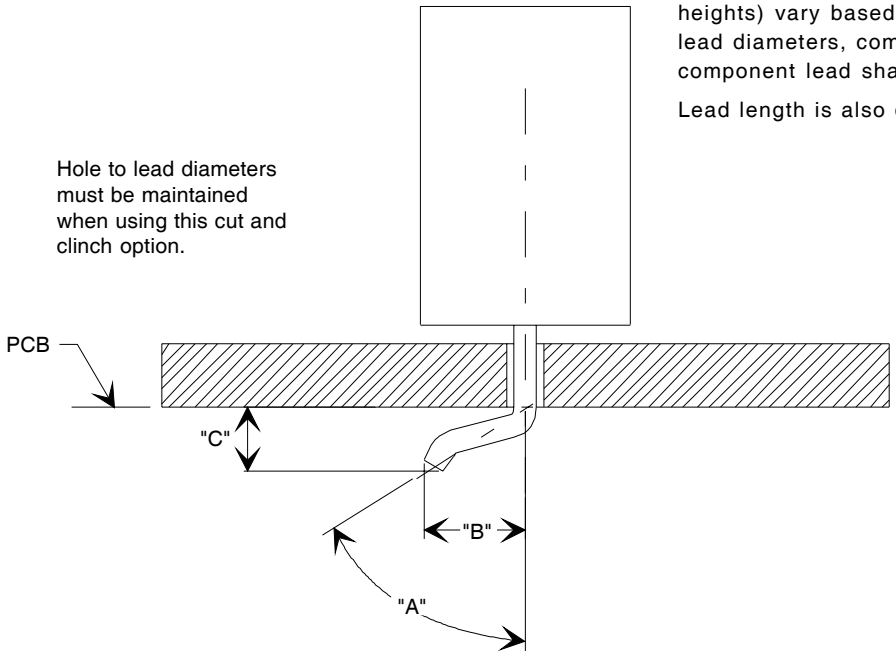
"C" Lead Height 0.91 mm ± 0.30 mm
(0.036 ± 0.012")

Notes:

1. Values A, B, and C in this example were obtained with the difference between hole and lead diameter of 0.48 mm (0.019").
2. Specifications for this cut and clinch (lead angles, lengths and heights) vary based on PC board hole diameters, component lead diameters, component lead material composition and component lead shape (round, square and flat).

   Lead length is also dependent on tooling window openings.

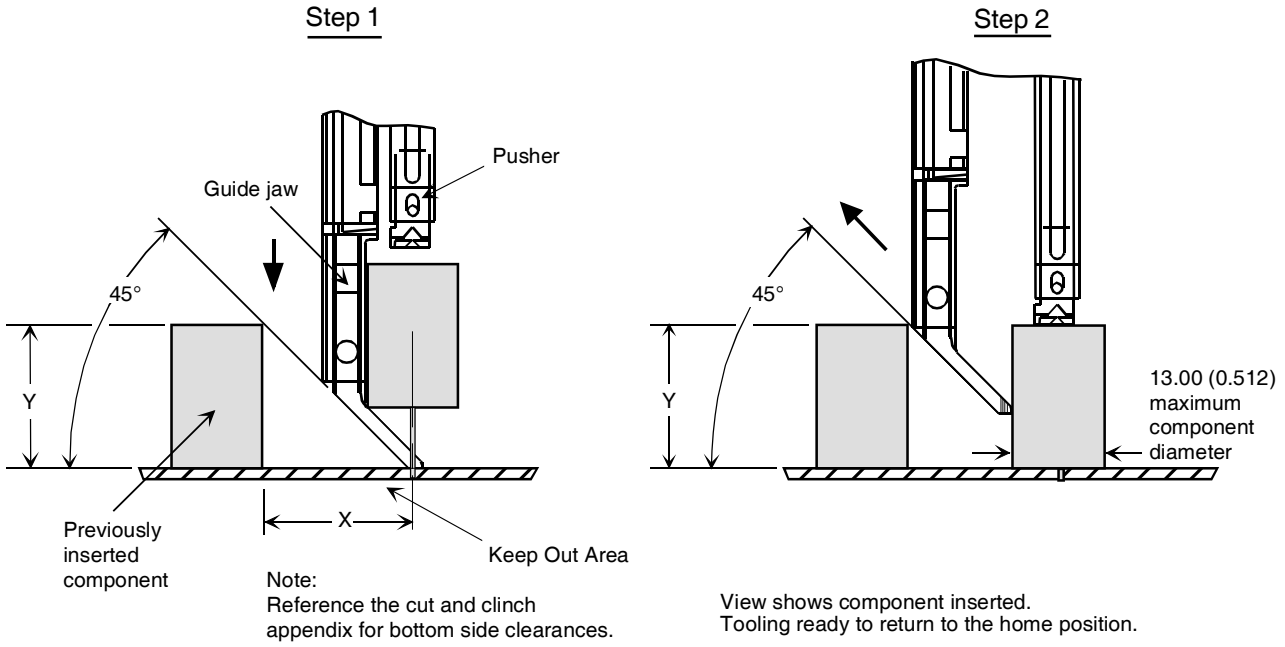
Hole to lead diameters must be maintained when using this cut and clinch option.



Insertion Head Footprints

Backside Density (13.0 mm Body Diameter Tooling)

Dimensions are in millimeters;
inch equivalents are bracketed.



Note:
Reference the cut and clinch appendix for bottom side clearances.

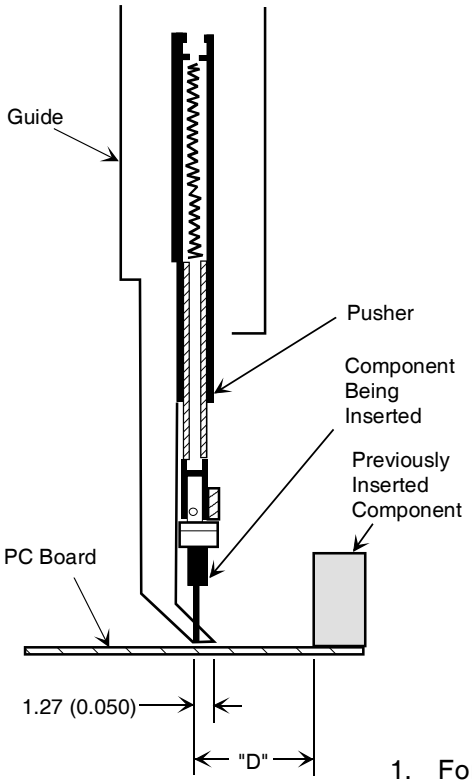
View shows component inserted.
Tooling ready to return to the home position.

Formula: X (Keep Out Area) **= Y** (Previously Inserted Component Height) **+ 0.48 mm (0.019")**

Frontside Density

2.5 mm/5.0 mm Insertion Clearances

Dimensions are in millimeters;
inch equivalents are bracketed.



Note: Reference the cut and clinch appendix for bottom side clearances.

1. For components being inserted with body diameter or width >6.35 mm (0.250").

$$D = \frac{\text{Body Diameter or Width}}{2} + 0.2 \text{ mm } (0.008")$$

2. For components being inserted with body diameter or width < 6.35 mm (0.250")
and

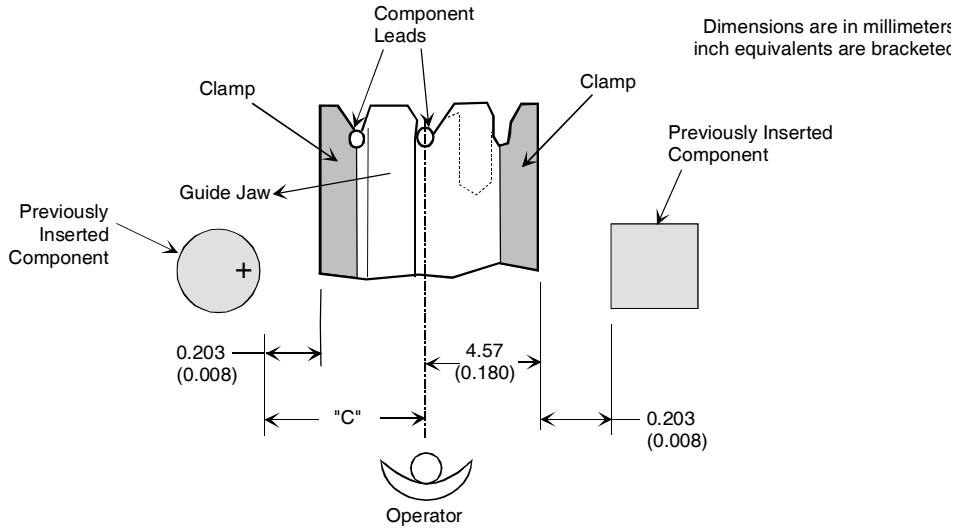
a. same height or taller than adjacent device;

$$D = \frac{\text{Body Diameter or Width} + 0.2 \text{ mm } (0.008")}{2} \quad \begin{matrix}(\text{Min } 1.47 \text{ mm}) \\ (\text{Min } 0.058")\end{matrix}$$

b. Shorter than adjacent device; D = 3.38 mm (0.133")

Side-to-Side Density: 2.5 mm/5.0 mm Tooling

2.5 mm Component Top View



For body diameter or length of component being inserted < 6.60 (0.260),

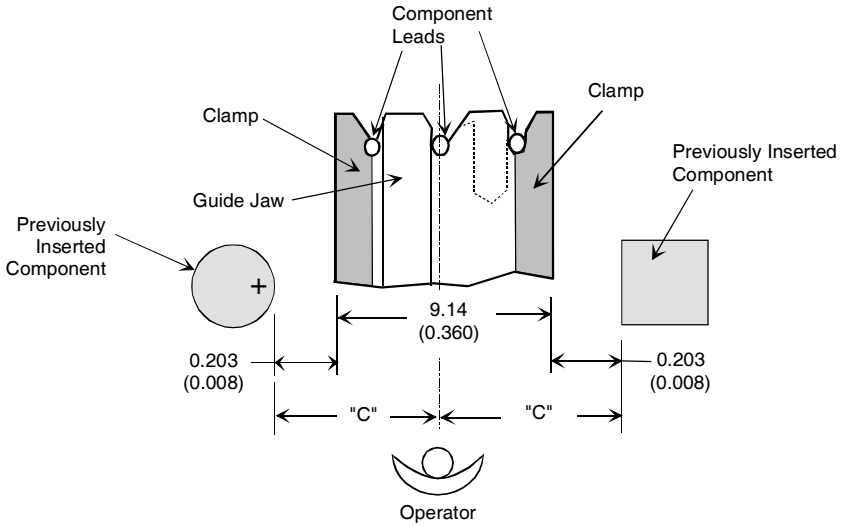
C = 4.78 (0.188) *or*

For body diameter or length of component being inserted > 6.60 (0.260),

$C = \frac{\text{(Body Diameter)}}{2} + 1.47\ (0.058)$

Note: Tooling shown in open position, top side of tooling.

5.0mm Component Top View



For body diameter or length of component being inserted < 9.14 (0.360),

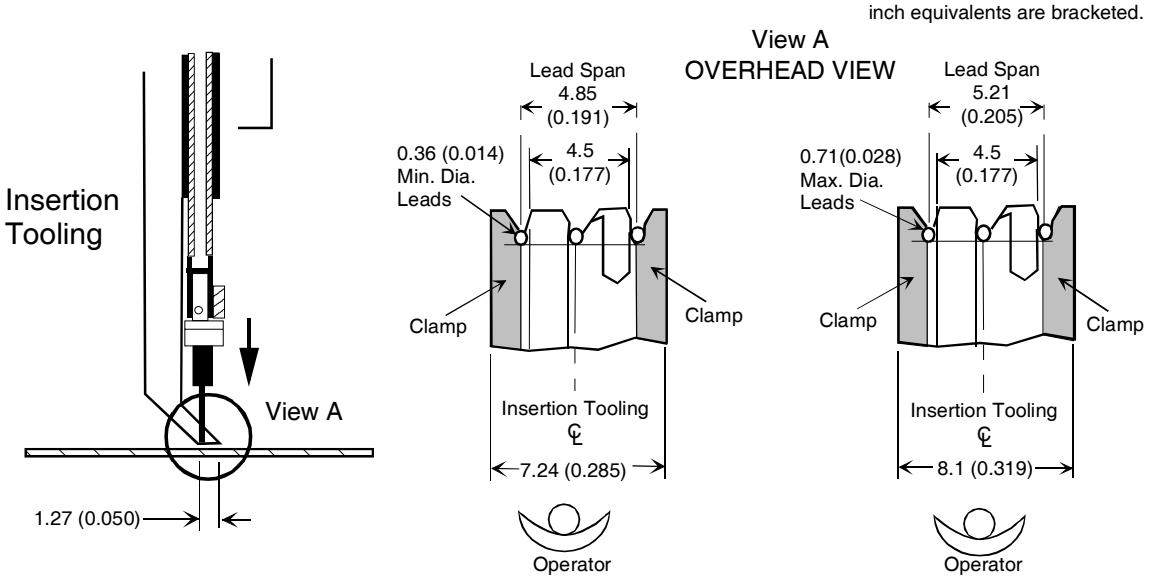
C = 4.78 (0.188) *or*

For body diameter or length of component being inserted > 9.14 (0.360),

$C = \frac{\text{(Body Diameter)}}{2} + 0.203\ (0.008)$

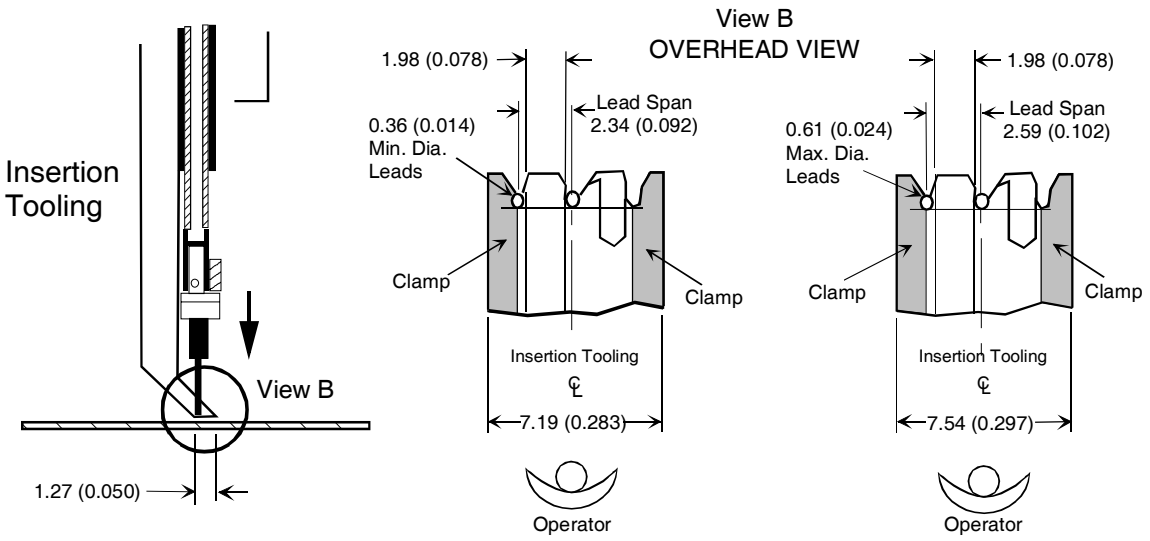
5.0 mm
"Lead Hole Span"- to -"Lead Diameter" Relationship

Dimensions are in millimeters;
inch equivalents are bracketed.



View shows minimum and maximum diameter leads clamped, showing overall dimension and lead span relationship to lead diameter.

2.5 mm
"Lead Hole Span"- to -"Lead Diameter" Relationship



View shows minimum and maximum diameter leads clamped, showing overall dimension and lead span relationship to lead diameter.

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Triple Span Specific Technical Specifications (2.5 mm/5.0 mm/7.5 mm)

- Component Input/Taping Specifications
- Cut & Clinch
- Insertion Head Footprints

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Component Input/Taping Specifications

Components taped in a radial format meeting the specifications contained in this GS are approved to be used in the Radial 8XT.

Most specifications in this GS are based on EIA-468, "Lead Taping of Components in the Radial Configuration for Automatic Handling".

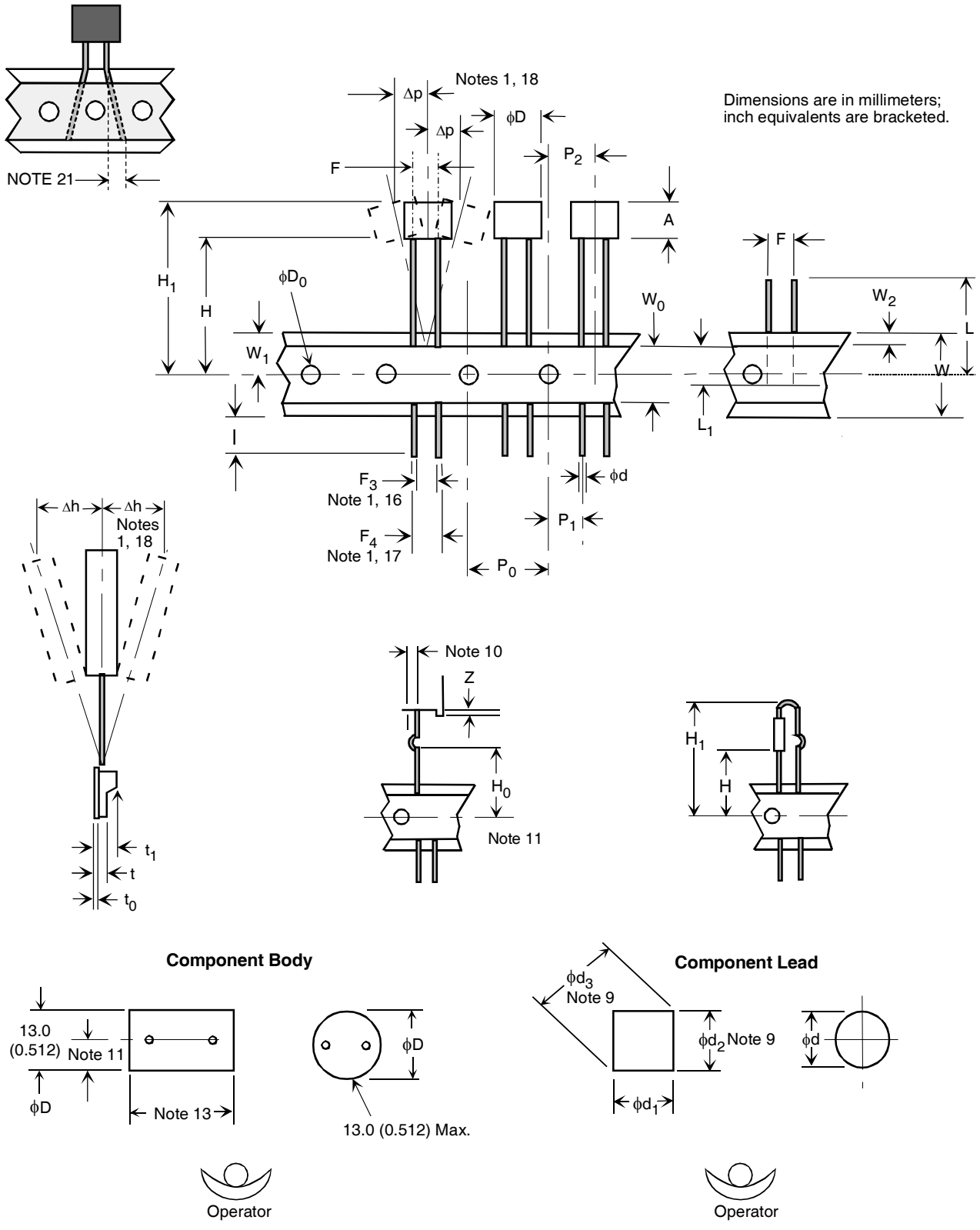
Lead spans of 2.5 mm/5.0 mm/7.5 mm on 12.7 mm or 15.0 mm tape pitch are standard.

When radially taped components fall outside of Universal specifications, consult a Universal Sales Engineer.

Maximum Component Weight

The Radial 8XT inserts a component weighing up to 5 grams. Mass and the center of gravity affect these limitations. A short 5 gram component with a center of gravity 20.32 mm (0.80") above the feed hole may run satisfactorily, but a tall 5 gram component with a center of gravity 35.56 mm (1.40") above the feed hole may move up or down in the chain clip, affecting reliability.

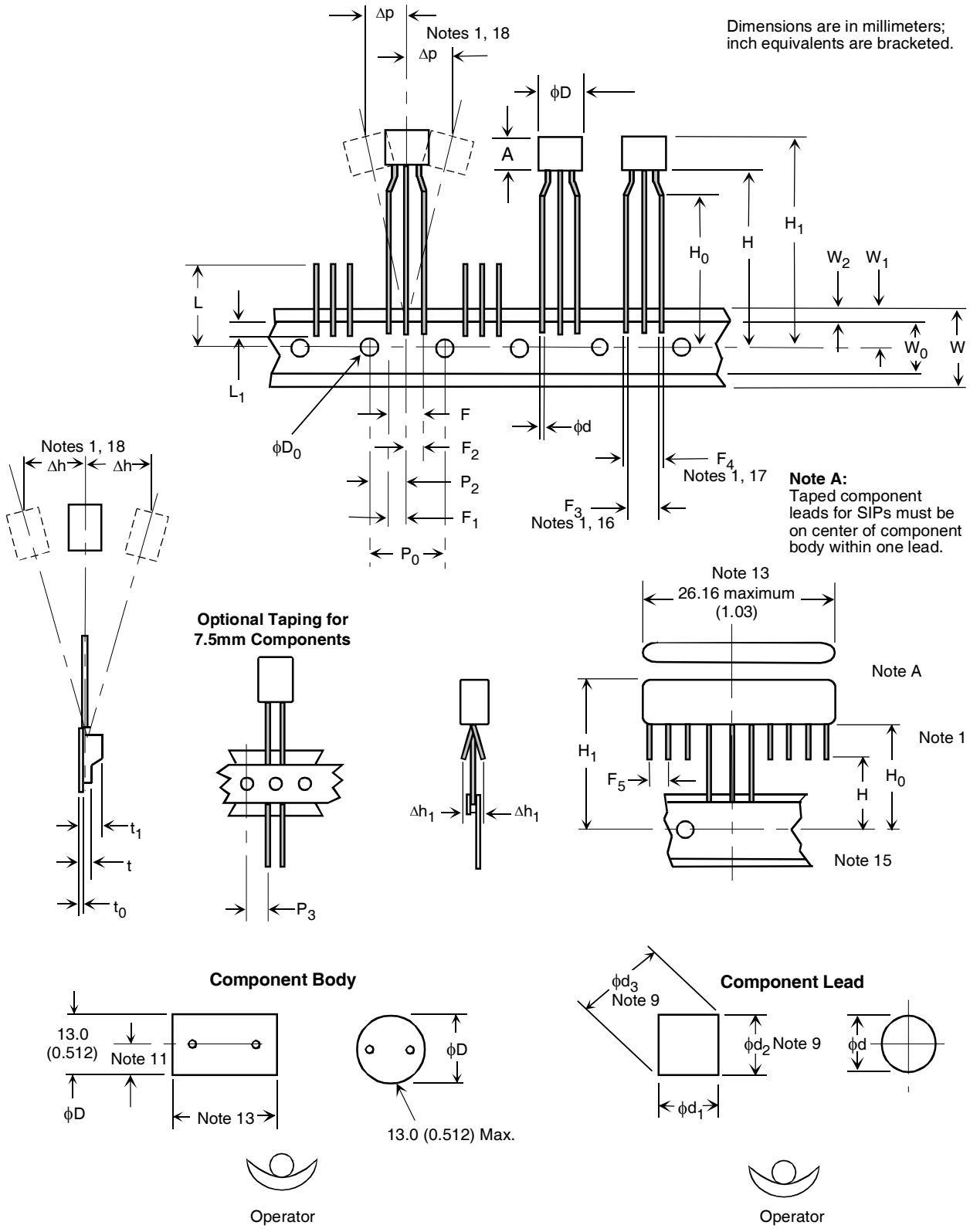
Two-Leaded Components



TWO-LEADED COMPONENT SPECIFICATIONS							
			Minimum		Maximum		
Symbol	Item		mm	inch	mm	inch	Notes
A	Component Body Height		0.36	0.014	23.0	0.906	
ϕD_0	Feed Hole Diameter		3.7	0.146	4.3	0.169	
ϕd	Lead Diameter (Round)		0.36	0.014	0.86	0.034	12, 22
ϕD	Component Body Diameter		N/A	N/A	13.0	0.512	19
$\phi d_1, \phi d_2$	Lead Size (Rectangular)		0.28	0.011	0.81	0.032	9, 12, 22
ϕd_3	Lead Across (Diagonal)		0.38	0.015	0.86	0.034	9, 12, 22
F	Component Lead Span	2.5 mm	2.34	0.092	3.15	0.124	1, 5
		5.0 mm	4.88	0.192	5.69	0.224	1, 5
		7.5 mm	7.42	0.292	8.22	0.324	1, 5
F_1, F_2	Component Lead Pitch*		N/A	N/A	N/A	N/A	
F_3	Minimum Inner Spacing Between Leads	2.5 mm	1.65	0.065	N/A	N/A	1, 5, 16
		5.0 mm	4.19	0.165	N/A	N/A	1, 5, 16
		7.5 mm	6.73	0.265	N/A	N/A	1, 5, 16
F_4	Maximum Outer Spacing	2.5 mm	N/A	N/A	3.68	0.145	
		5.0 mm	N/A	N/A	6.22	0.245	
		7.5 mm	N/A	N/A	8.76	0.345	
F_5	Lead Pitch		2.4	0.096	2.6	0.104	
H_0	Height of Seating Plane		15.5	0.610	22.5	0.886	
H	Feed Hole to Bottom of Component		15.5	0.610	22.5	0.886	11, 20
H_1	Component Height		15.85	0.624	38.5	1.515	14
Δh	Front-to-Rear Deflection		0.0	0.000	1.0	0.039	1, 18
Δh_1	Lead Deflection		N/A	N/A	0.1	0.004	
I	Lead Protrusion		0.0	0.000	1.0	0.039	
L	Lead Length After Component Removal		8.51	0.335	11.2	0.441	3
L_1	Lead Wire Enclosure		2.49	0.098	18.31	0.721	
P_0	Feed Hole Pitch		12.4	0.488	13.0	0.512	4
P_1	Lead Location	2.5 mm	4.37	0.172	5.79	0.228	5, 18
		5.0 mm	3.10	0.122	4.52	0.178	5, 18
		7.5 mm	1.84	0.072	3.24	0.128	5, 18
P_2	Ordinate To Component Center		5.64	0.222	7.06	0.278	5
P_3	Alternate Lead Location	7.5 mm	8.19	0.322	9.59	0.378	5, 17, 18
Δ_P	Deflection Left or Right		00	0.000	1.3	0.051	1, 18
t	Overall Tape Thickness		0.51	0.020	0.90	0.035	6
t_0	Carrier Tape Thickness		0.38	0.015	0.69	0.027	
t_1	Total Taped Package Thickness		0.86	0.034	1.96	0.077	6
W	Tape Width		17.5	0.689	19.0	0.748	7
W_0	Adhesive Tape Width		5.50	0.216	19.0	0.748	7
W_1	Feed Hole Location		8.5	0.335	9.75	0.384	
W_2	Adhesive Tape Position		0.0	0.000	6.0	0.236	7
Z	Standoff Extensions		0.0	0.000	1.0	0.039	

* Applies to three-leaded components only.

Three-Leaded Components



THREE-LEADED COMPONENT SPECIFICATIONS							
			Minimum		Maximum		
Symbol	Item		mm	inch	mm	inch	Notes
A	Component Body Height		0.36	0.014	23.0	0.906	
ϕD_0	Feed Hole Diameter		3.7	0.146	4.3	0.169	
ϕd	Lead Diameter (Round)		0.36	0.014	0.86	0.034	9, 22
ϕD	Component Body Diameter		0.71	0.028	13.0	0.512	1
ϕd_1, ϕd_2	Lead Size (Rectangular)		0.28	0.011	0.81	0.032	22
ϕd_3	Lead Across (Diagonal)		0.38	0.015	0.86	0.034	9, 12, 22
F	Component Lead Span	2.5 mm	2.34	0.092	3.15	0.124	1, 5
		5.0 mm	4.88	0.192	5.69	0.224	1, 5
F_1, F_2	Component Lead Pitch		2.4	0.094	2.9	0.114	1
F_3	Minimum Inner Spacing Between Leads	2.5 mm	1.65	0.065	N/A	N/A	1, 5, 16
		5.0 mm	4.19	0.165	N/A	N/A	1, 5, 16
F_4	Maximum Outer Spacing	2.5 mm	N/A	N/A	3.68	0.145	
		5.0 mm	N/A	N/A	6.22	0.245	
F_5	Lead Pitch		2.4	0.096	2.6	0.104	
H_0	Height of Seating Plane		15.5	0.610	22.5	0.886	
H	Feed Hole to Bottom of Component		15.5	0.610	22.5	0.886	11, 20
H_1	Component Height		15.85	0.624	41	1.61	14
Δh	Front-to-Rear Deflection		0.0	0.000	1.0	0.039	1
Δh_1	Lead Deflection		N/A	N/A	0.1	0.004	
I	Lead Protrusion		0.0	0.000	1.0	0.039	
L	Lead Length After Component Removal		8.51	0.335	11.2	0.441	3
L_1	Lead Wire Enclosure		2.49	0.098	18.31	0.721	
P_0	Feed Hole Pitch		12.4	0.488	13.0	0.512	4
P_1	Lead Location		3.11	0.122	4.51	0.178	5
P_2	Ordinate to Component Center		5.95	0.234	6.75	0.266	5
P_3	Alternate Lead Location*		N/A	N/A	N/A	N/A	
Δp	Deflection Left or Right		0.0	0.000	1.3	0.051	1
t	Overall Tape Thickness		0.51	0.020	0.89	0.035	6
t_0	Carrier Tape Thickness		0.38	0.015	0.69	0.027	
t_1	Total Taped Package Thickness		0.86	0.034	1.96	0.077	6
W	Tape Width		17.5	0.689	19.0	0.748	7
W_0	Adhesive Tape Width		5.50	0.216	19.0	0.748	7
W_1	Feed Hole Location		8.5	0.335	9.75	0.384	
W_2	Adhesive Tape Position		0.0	0.000	6.0	0.236	7
Z	Standoff Extensions		0.0	0.000	1.0	0.039	

*Applies to two-leaded components only.

NOTES

1. Maximum alignment deviation or parallelism between leads shall not be greater than 0.25 mm (0.010"). This dimension also applies to the component leads after the cardboard has been removed and to all untaped leads.
2. The distance between the tape feed hole and the bottom of the component, and the distance between the tape feed hole and the leads standoff form, shall be equal within 1.0 mm (0.039").
3. When defective components are clipped from the carrier tape, the remaining protrusion of the leads shall not exceed W_1 + 1.0 mm (W_1 + 0.039").
4. Maximum cumulative variation between tape feed holes shall not exceed +0.5 mm (+0.020") over four pitches.
5. P_1 and F are measured at the lead egress from the carrier tape on the component side (P_1 shall not deviate more than +/- 0.13 mm (0.005") on the same component reel). P_2 is measured at the seating plane.
6. Overall tape package thickness (t_1), including component leads and tape splices, shall not exceed 1.5 mm (0.059").
7. Hold-down tape not to extend beyond the edge(s) of the carrier tape and there shall not be exposure of the adhesive.
8. For components with standoffs, the dimension is measured from the centerline of the feed hole to the inside radius of the form.
9. Minimum/maximum conditions applying to square and rectangular leads are measured on the diagonal ($Ød_3$). The value of $Ød_3$ must be greater than 0.38 mm (0.015") and less than 0.86 mm (0.034"). To calculate the diameter of square or rectangular component leads, apply this formula:

$$Ød_3 = \sqrt{Ød_2^2 + Ød_1^2}$$

10. Dimension to be 0.38 mm (0.015") larger than hole diameter in the board.
11. If leads are off center of component body, effective ØD dimension = 2x distance from center line of component leads to furthermost edge of component body.
12. Running steel leads with 0.81 mm (0.031") diameter will decrease clinch tooling life.
13. Parts longer than 12.39 mm (0.488"), for example, SIP type components, must be taped 25.4 mm (1") on center. Parts taped in this manner result in an increase in transfer time from dispenser head to carrier clip. Consult a Universal Sales Engineer for 15 mm (0.59") or 30 mm (1.18") pitch.

NOTES

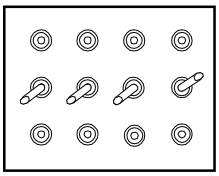
14. The distance between the bottom of the guide jaw to bottom of the pusher tip when in full up position is 30.73 mm (1.210"). Full downward travel of the insertion pusher extends to surface of printed circuit board or top of component, whichever is greater.
15. Dimension applies to untaped leads.
16. F_3 dimension is designed to limit the minimum lead span of taped components.
17. F_4 dimension is designed to limit the maximum lead span of the taped component.
18. Component deflection (Δh, Δp) is measured from the centerline of the component at the center top of the component.
19. ØD max is 13.0 mm.
20. Minimum H dimension increases with body diameter. See below. Maximum H dimension is not affected.

Dimensions are in millimeters;
inch equivalents are bracketed.

13.0mm Tooling Style	
ϕD round or rectangle	H Minimum
6.15 (0.242)	15.5 (0.610)
7.0 (0.276)	16.0 (0.630)
8.0 (0.315)	16.5 (0.650)
9.0 (0.354)	17.0 (0.669)
10.0 (0.394)	17.5 (0.689)
11.0 (0.433)	18.0 (0.709)
12.0 (0.472)	18.5 (0.728)
13.0 (0.512)	19.0 (0.748)

21. Leads can not be formed outward more than 1.0 mm (0.039") within the carrier tape. There is no limit on inward formation within the carrier tape.
22. Lead specifications contained in this GS apply to lead size and geometry. Lead material as well as lead finish and coating may affect the ability of a component to be successfully processed using automatic insertion equipment.
23. 15mm pitch - Notes and dimensions on these pages apply to 12.7mm pitch components. Similar dimensions apply to 15mm pitch components.

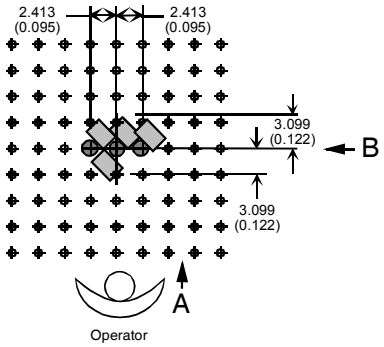
Cut and Clinch



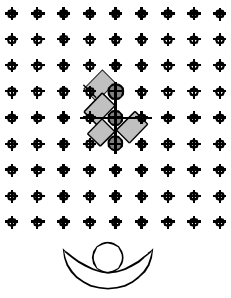
Cut and Clinch, "N-Type," Long Lead for 2.5 mm/5.0 mm/7.5 mm Components

The N-type cut and clinch can cut and clinch 2- and 3-leaded components (2.5 mm/5.0 mm/7.5 mm). The cut and clinch footprint and recommended clearances are shown below.

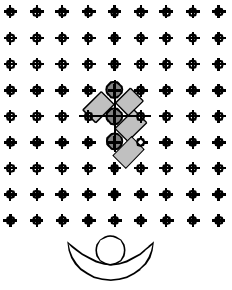
Footprint and Clearances for "N-Type" Long Lead Cut and Clinch Holes Represent PC Board Holes at 2.54 mm (0.100") Spacing



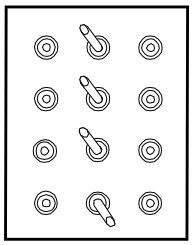
1mm (0.039) Below Board
0° Position



1mm (0.039) Below Board
90° Position Right



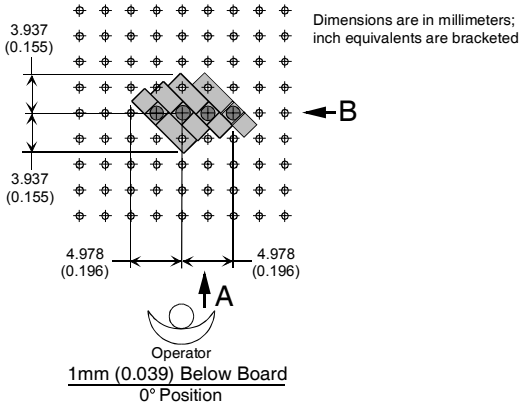
1mm (0.039) Below Board
270° Position Left



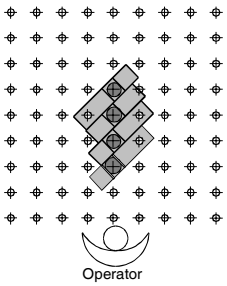
Cut and Clinch, "N-Type," Short Lead for 2.5 mm/5.0 mm/7.5 mm Components

The N-type cut and clinch can cut and clinch 2- and 3-leaded components (2.5 mm/5.0 mm/7.5 mm). The cut and clinch footprint and recommended clearances are shown below.

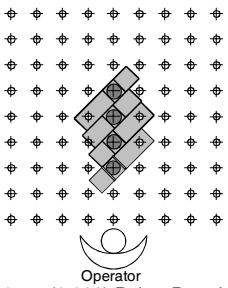
Footprint and Clearances for "N-Type" Short Lead Cut and Clinch Holes Represent PC Board Holes at 2.54 mm (0.100") Spacing



1mm (0.039) Below Board
0° Position

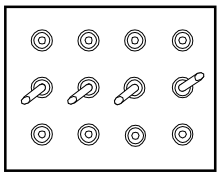


1mm (0.039) Below Board
270° Position Left



1mm (0.039) Below Board
90° Position Right

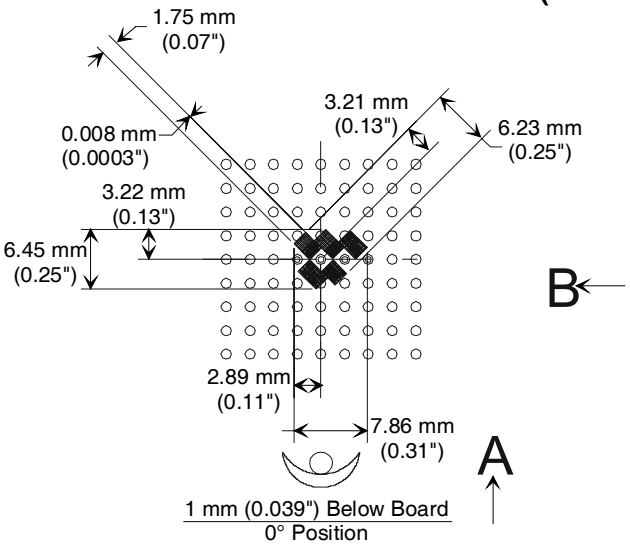
Cut and Clinch

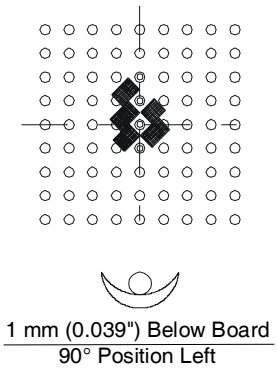


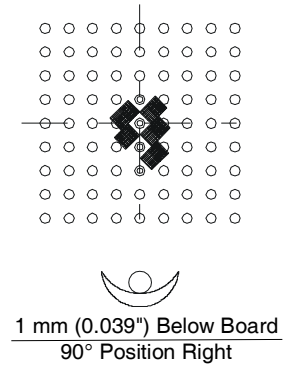
Cut and Clinch, "N-Type," Standard Lead for 2.5 mm/5.0 mm/7.5 mm Components

The N-type cut and clinch can cut and clinch 2- and 3-leaded components (2.5 mm/5.0 mm/7.5 mm). The cut and clinch footprint and recommended clearances are shown below.

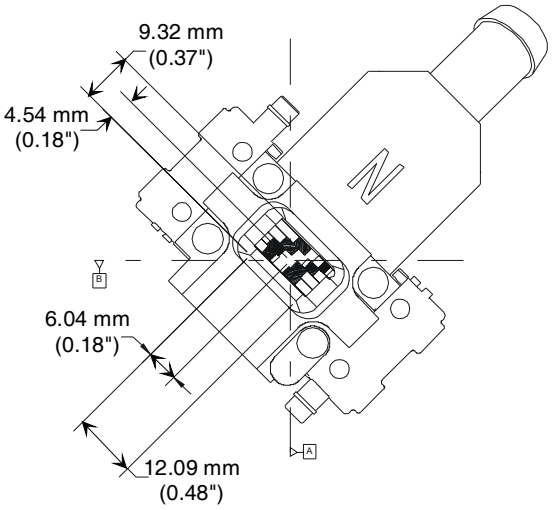
Footprint and Clearances for "N-Type" Standard Lead Cut and Clinch
Holes Represent PC Board Holes at 2.54 mm (0.100") Spacing

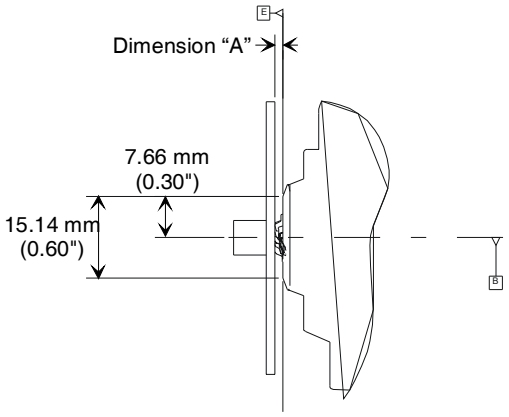




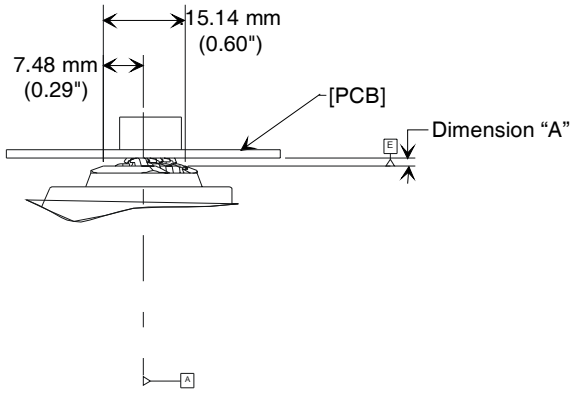


Below Board Clearence, "N-Type," Triple Span





VIEW B



VIEW A

CLINCH STYLE	DIMENSION "A"
SHORT LEAD N	1.86 mm (0.07")
STANDARD LEAD N	1.48 mm (0.06")
LONG LEAD N	1.74 mm (0.07")

Cut and Clinch Lead Direction

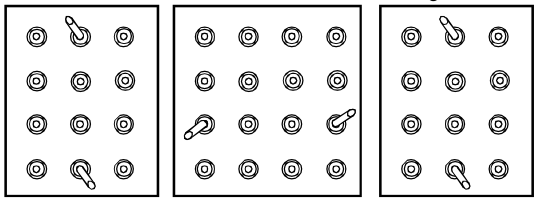
The cut and clinch tooling matrix that follows is provided as a comparison of current standard Universal cut and clinch tooling. Compared are cut and clinch tooling patterns as viewed from the underside of the printed circuit board. Parameters are based on theoretical values. Cut and Clinch tooling parameters shown are examples for reference only.

Tooling Pattern as Viewed from Underside of PC Board

"N-Type"
Long, Short, and Standard Lead
(2.5 mm/5.0 mm/7.5 mm)

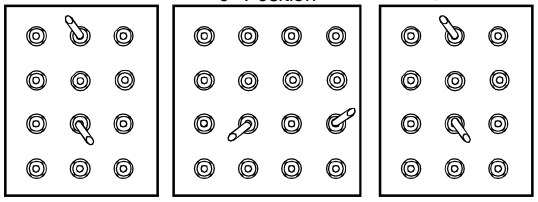
7.5 mm, 2-Lead

Cutter Hd 270° Left Position | Cutter Hd 0° Position | Cutter Hd 90° Right Position



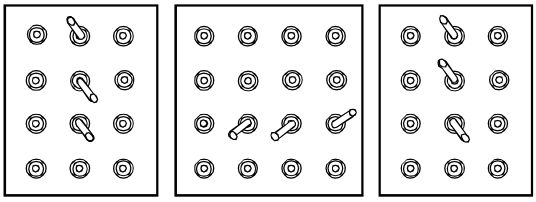
5.0 mm, 2-Lead

Cutter Hd 270° Left Position | Cutter Hd 0° Position | Cutter Hd 90° Right Position



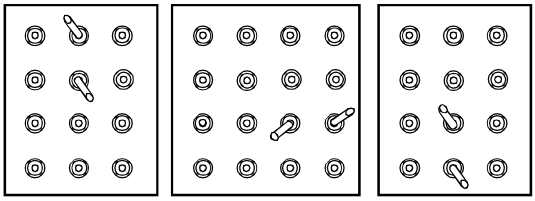
5.0 mm, 3-Lead

Cutter Hd 270° Left Position | Cutter Hd 0° Position | Cutter Hd 90° Right Position



2.5 mm, 2-Lead

Cutter Hd 270° Left Position | Cutter Hd 0° Position | Cutter Hd 90° Right Position



Note:
1. Lead angles are measured from the vertical position.

Cut and Clinch Lead Dimensions

"N-Type" Long Lead (2.5 mm/5.0 mm/7.5 mm)

"A" Lead Angle approximately 55°

"B" Lead Length 1.52 mm ± 0.38 mm
(0.060 ± 0.015")

"C" Lead Height 1.07 mm ± 0.33 mm
(0.042 ± 0.013")

"N-Type" Short Lead (2.5 mm/5.0 mm/7.5 mm)

"A" Lead Angle approximately 57°

"B" Lead Length 1.27 mm ± 0.38 mm
(0.050 ± 0.015")

"C" Lead Height 0.81 mm ± 0.25mm
(0.032 ± 0.010")

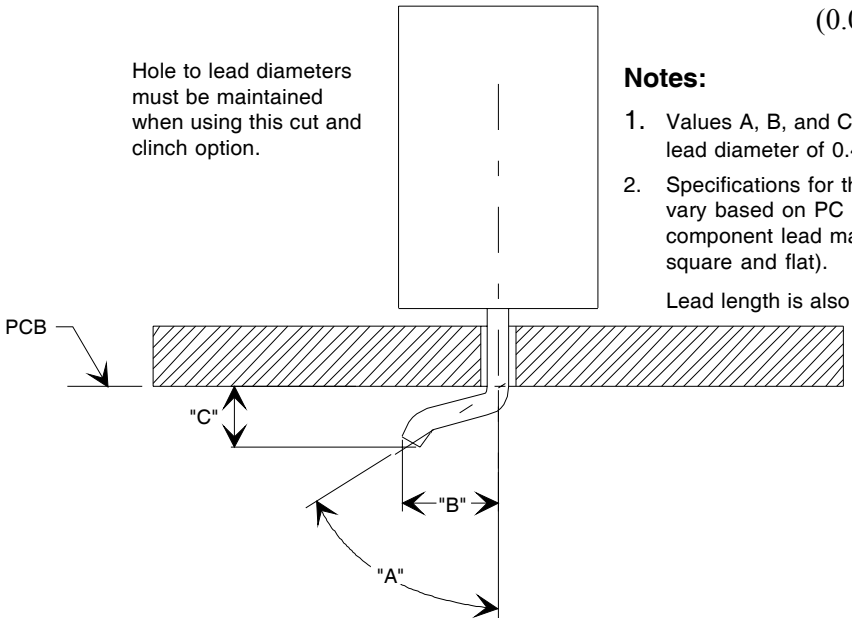
"N-Type" Standard Lead (2.5 mm/5.0 mm/7.5 mm)

"A" Lead Angle approximately 57°

"B" Lead Length 1.4 mm ± 0.38 mm
(0.055 ± 0.015")

"C" Lead Height 0.91 mm ± 0.30 mm
(0.036 ± 0.012")

Hole to lead diameters must be maintained when using this cut and clinch option.



Notes:

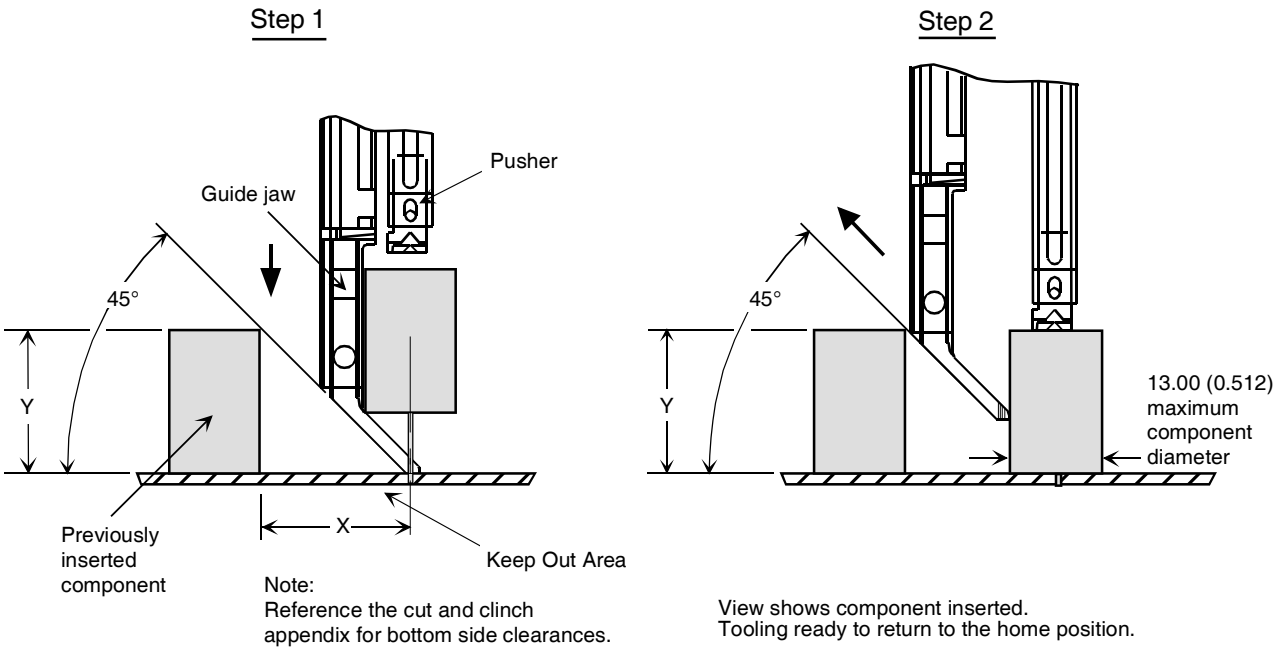
1. Values A, B, and C were obtained with the difference between hole and lead diameter of 0.483 mm (0.019").
2. Specifications for this cut and clinch (lead angles, lengths and heights) vary based on PC board hole diameters, component lead diameters, component lead material composition and component lead shape (round, square and flat).

   Lead length is also dependent on tooling window openings.

Insertion Head Footprints

Backside Density (13.0 mm Body Diameter Tooling)

Dimensions are in millimeters;
inch equivalents are bracketed.

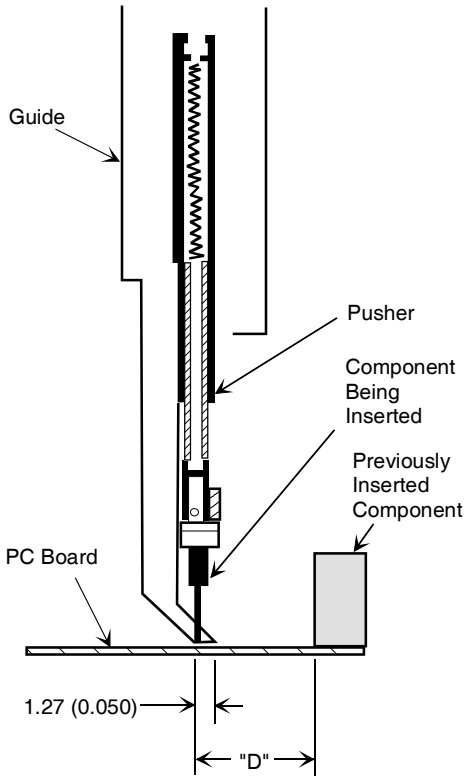


Note:
Reference the cut and clinch appendix for bottom side clearances.

View shows component inserted.
Tooling ready to return to the home position.

Formula: X (Keep Out Area) **= Y** (Previously Inserted Component Height) **+ 0.48 mm (0.019")**

Frontside Density



Dimensions are in millimeters;
inch equivalents are bracketed.

Note: Reference the cut and clinch appendix for bottom side clearances.

1. For components being inserted with body diameter or width > 6.35 mm (0.250").

$$D = \frac{\text{Body Diameter or Width}}{2} + 0.2 \text{ mm } (0.008")$$

2. For components being inserted with body diameter or width < 6.35 mm (0.250")
and

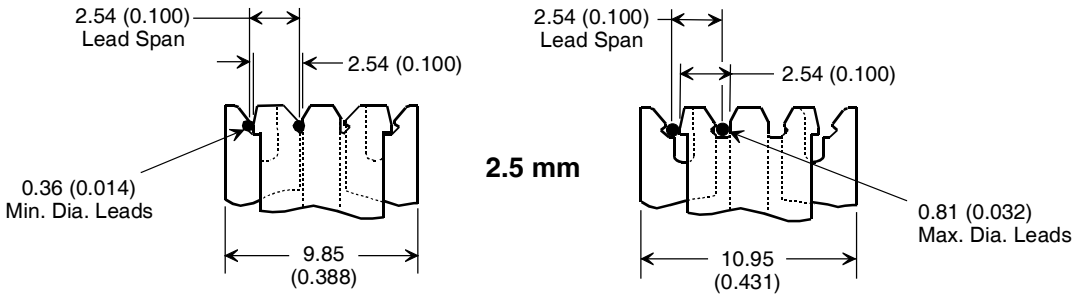
a. same height or taller than adjacent device;

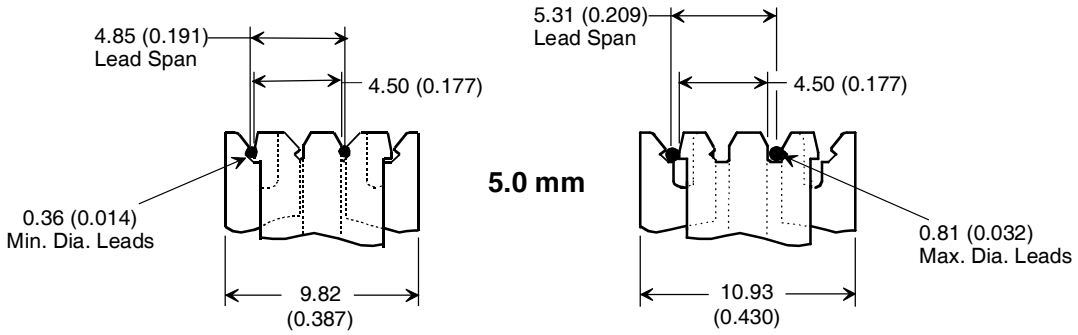
$$D = \frac{\text{Body Diameter or Width}}{2} + 0.2 \text{ mm. } (008") \text{ Min. } 1.47 \text{ mm } (\text{Min } 0.058")$$

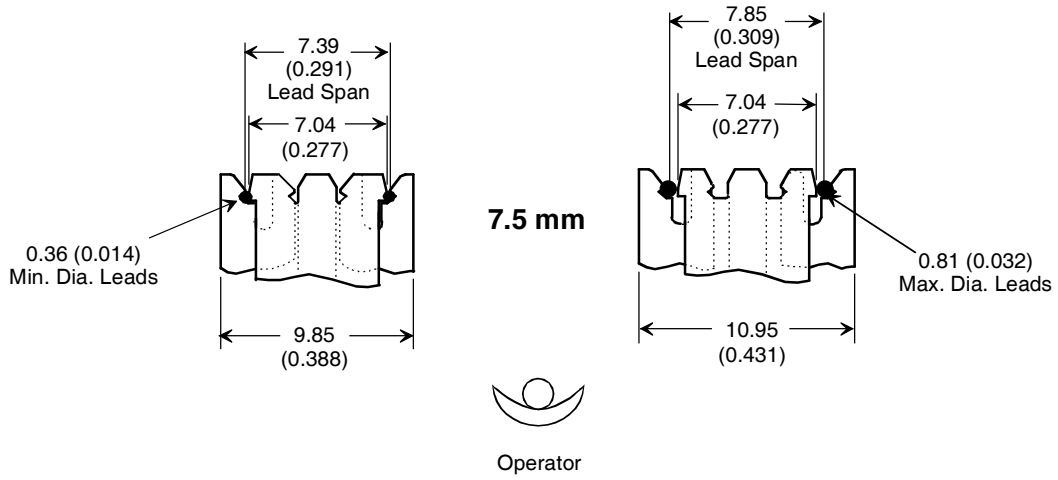
b. Shorter than adjacent device; D = 3.38 mm (0.133")

Insertion Head 2.5 mm/5.0 mm/7.5 mm Span, 13.0 mm Body

Dimensions are in millimeters;
inch equivalents are bracketed.



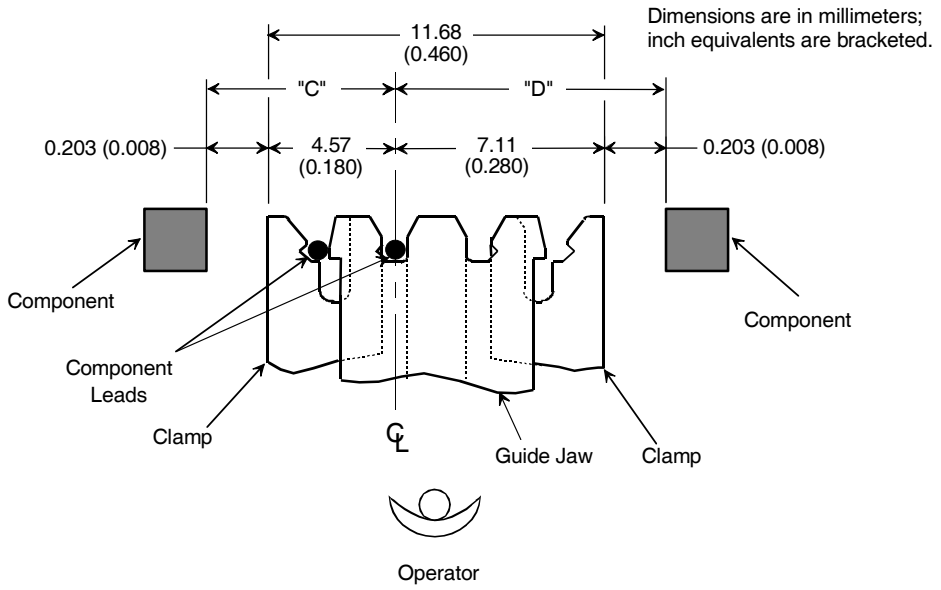




Note:
View shows minimum and maximum diameter leads clamped, overall dimensions and lead span relationship to lead diameter. View is top side of the tooling.

Side-to-Side Density, 2.5 mm Component Top View

2.5 mm/5.0 mm/7.5 mm Tooling



For body diameter or length of component being inserted < 6.60 mm (0.260")
C = 4.78 mm (0.188") *or*
For body diameter or length of component being inserted > 6.60 mm (0.260")

$$C = \frac{\text{(body diameter)}}{2} + 0.20 \text{ mm } (0.008") \text{ } or$$

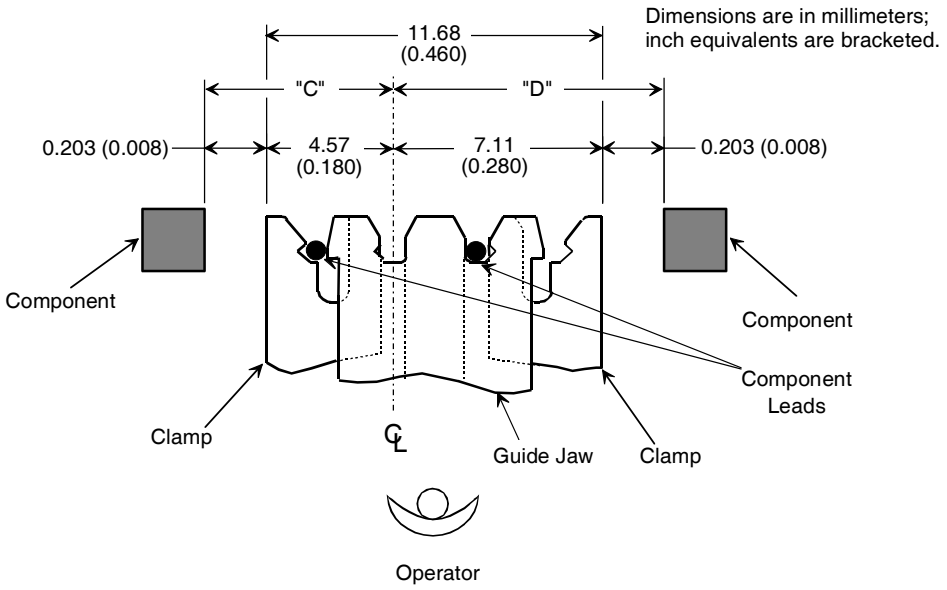
For body diameter or length of component being inserted >16.76 mm (0.660")

$$D = \frac{\text{(body diameter)}}{2} + 0.20 \text{ mm } (0.008")$$

Tooling shown in unclamped, top side position.

Side-to-Side Density, 5.0mm Component Top View

2.5 mm/5.0 mm/7.5 mm Tooling



For body diameter or length of component being inserted < 9.14 mm (0.360")
C = 4.78 mm (0.188") *or*
For body diameter or length of component being inserted > 9.14 mm (0.360")

$$C = \frac{\text{(body diameter)}}{2} + 0.20 \text{ mm } (0.008") \text{ } or$$

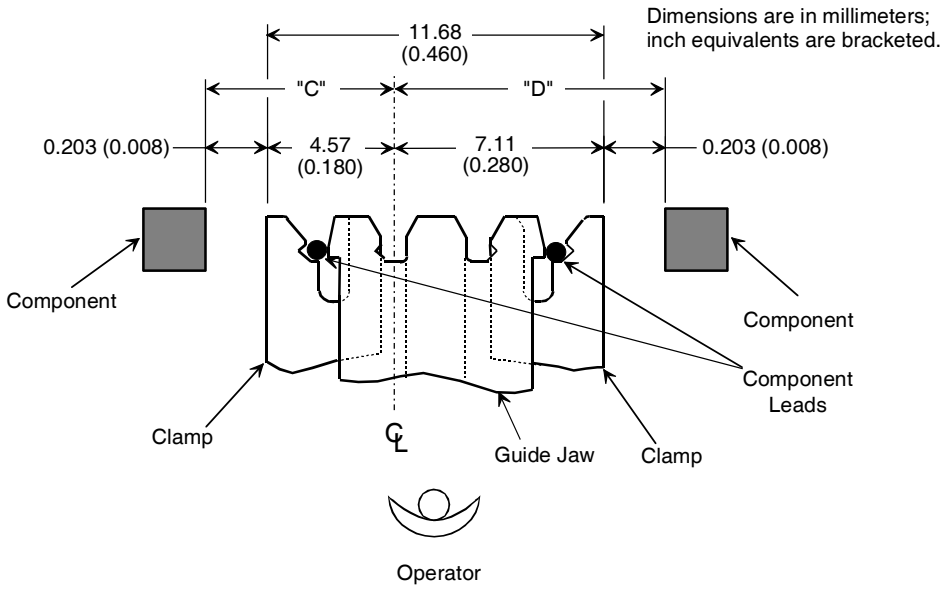
For body diameter or length of component being inserted >14.22 mm (0.560")

$$D = \frac{\text{(body diameter)}}{2} + 0.20 \text{ mm } (0.008")$$

Tooling shown in unclamped, top side position.

Side-to-Side Density, 7.5 mm Component Top View

2.5 mm/5.0 mm/7.5 mm Tooling



For body diameter or length of component being inserted < 11.68 mm (0.460")

C = 4.78 mm (0.188")

D = 7.32 mm (0.288"), *or*

For body diameter or length of component being inserted >11.68 mm (0.460")

$$C = \frac{\text{(body diameter)}}{2} - 1.07 \text{ mm } (0.042") \textit{ or}$$

$$D = \frac{\text{(body diameter)}}{2} + 1.4 \text{ mm } (0.058")$$

Tooling shown in unclamped, top side position.

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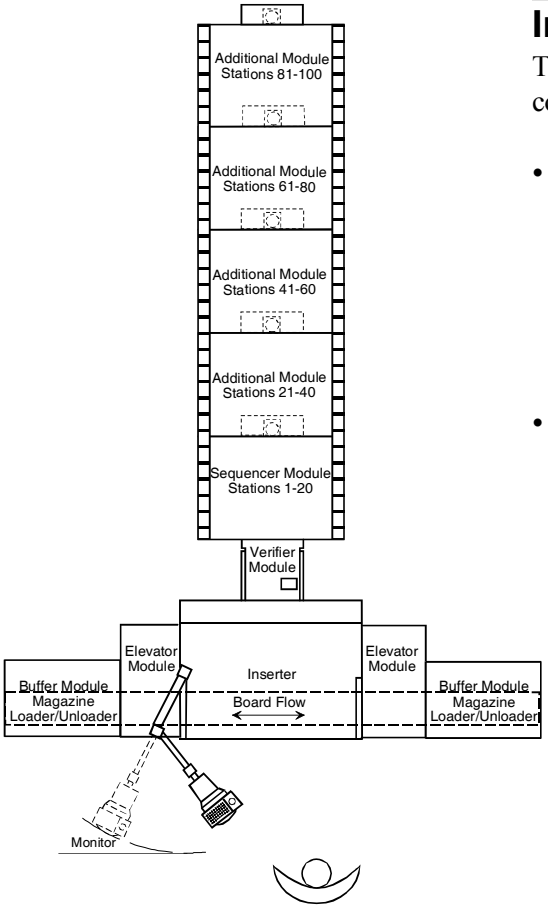
Appendix: Loader/Unloader with Board Handling

Details Common to Both Dual Span and Triple Span Radial 8XT

Appendix: Loader/Unloader with Board Handling

CE



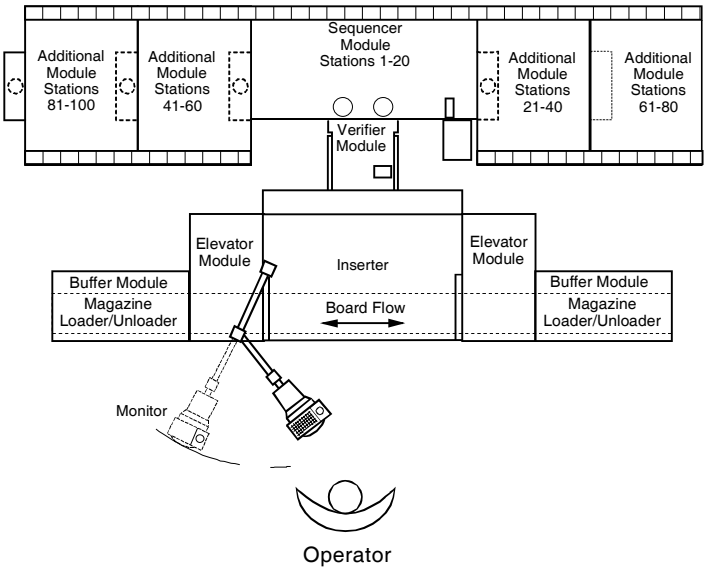
Straight Back Sequencer Configuration

Introduction

The Radial 8XT is available in several automatic board handling configurations:

- **Magazine-to-Magazine Configuration:** Magazines containing PC boards are placed on the input Elevator (Loader) and the PC boards are then automatically transferred into the machine for component insertion. Once completed, the boards are unloaded into an output magazine Elevator (Unloader). Each Elevator includes a magazine Buffer.

- **Internal Board Handling System (BHS):** Internal BHS for in-line systems integration is also available. Two PC boards, one for input and one for output, quickly and reliably transfer. Transfer direction may be specified when ordering the machine, prior to manufacture, and quick and easy manual width adjustment handles a wide range of PC board sizes. The front fixed rail is standard and all operator PC board changeover adjustments are readily accessible.



In-Line Sequencer Configuration

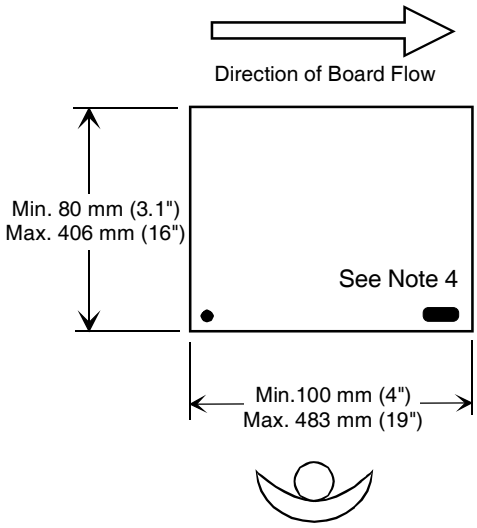
Technical Specifications for Internal Board Handling System (BHS)

Board Handling System Specifications

	Minimum	Maximum
Transfer Height[1]	1001.5 mm (39.43") to 955.8 mm (37.63") to	1014.2 mm (39.93"), or 968.5 mm (38.13")
Above Board Clearance	—	25.4 mm (1.00"), restricted by the Radial 8XT
Board Changeover	Manual	
Direction	Select right-to-left or left-to-right.	
Edge Clearance	5 mm (0.197") or 3 mm (0.118")[2]	
Fixed Edge	Front	
Locator Pins	Front	
Front Edge Distance	The front edge of the PC Board is fixed at 266.7mm (10.5") from the front of the machine. (The back rail of the board handling is adjustable.)	
Transfer Time[3]	2.5 seconds, maximum for 1007.9 mm (39.68") transfer height (upper level) 5.5 seconds, maximum for 962.2 mm (37.88") transfer height (lower level)	

Notes:

1. Transfer height can be configured, and alters transfer time. See transfer time specification.
2. Set at factory to 3 mm.
3. This time should be addedd to the park-to-park time in order to determine total board processing time.



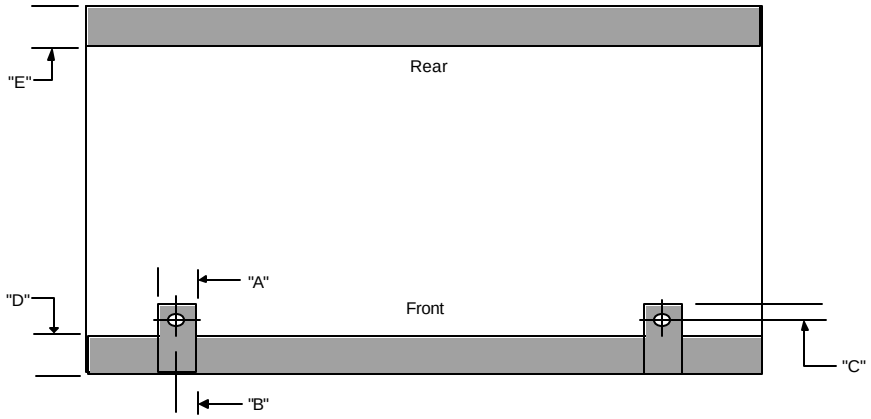
Board Specifications for BHS

	Minimum	Maximum
Length[1] x Width	102mm x 80mm (4" x 3.1") [2]	483mm x 406mm (19" x 16") [2]
Length to Width Ratio	1:1 or greater is recommended.	
Thickness	0.80mm (0.032")	2.36mm (0.093")
Cutouts	Contiguous edges	
Datum Hole Diameter	3.18mm (0.125") [2]	6.35mm (0.25") [2]
Datum Hole Location	See note 3	
Weight	2.27kg (5 pounds), maximum	

Notes:

1. Length is in the direction of board flow.
2. Consult a Universal Sales Engineer for other than stated sizes.
3. Two datum holes are required. For ease of setup, the workboard holder locator pins feature detents for PC board datum holes located 3.5, 4.0, 5.0, 6.35, or 7.62 mm from the front edge of the board. The maximum distance from the front edge of the PC board to the center of the datum holes is 9.0mm.
4. A slot in the X direction is recommended, instead of a round hole.

Board Handling System (BHS) Cut and Clinch Edge Clearance Specifications



A	7.12 mm (0.280")
B	3.56 mm (0.140")
C	4.06 mm (0.160")

PCB Locating Arm Dimensions

Cut and Clinch PCB Edge Clearances

D and E = The area that a component insertion center line must not cross when BHS is set to a standard 3mm edge clearance. If BHS is set to 5mm edge clearance, add 2mm (0.08") to the dimensions below.

Dual Span

"N-Type" Cut and Clinch"
(Long, Short, and Standard Lead)

	Head Rotation		
	0 Degrees	270 Degrees Left	90 Degrees Right
5mm Lead Span	D=8.80mm (0.345") E=8.80mm (0.345")	D=8.80mm (0.345") E=8.80mm (0.345")	D=8.80mm (0.345") E=8.80mm (0.345")
2.5mm Lead Span	D=8.80mm (0.345") E=8.80mm (0.345")	D=10.0mm (0.394") E=7.52mm (0.296")	D=7.52mm (0.296") E=10.0mm (0.394")

"T-Type" Cut and Clinch"

0 Degree Rotation	D and E = 4.62mm (0.182")
90 Degree Rotation	D and E = 8.43mm (0.332")

Triple Span

"N-Type" Cut and Clinch (Long, Short and Standard Lead)

"N" Style 2.5mm/5.0mm/7.5mm (Long Lead, Short Lead)			
	0°	**270° Left**	**90° Right**
2.5mm	D = 7.5 mm (0.295") E = 7.5 mm (0.295")	D = 7.3 mm (0.287") E = 11.6 mm (0.457")	D = 11.6 mm (0.457") E = 7.3 mm (0.287")
5.0mm	D = 7.5 mm (0.295") E = 7.5 mm (0.295")	D = 8.6 mm (0.339") E = 10.3 mm (0.405")	D = 10.3 mm (0.405") E = 8.6 mm (0.339")
7.5mm	D = 7.5 mm (0.295") E = 7.5 mm (0.295")	D = 9.8 mm (0.386") E = 9.0 mm (0.354")	D = 9.0 mm (0.354") E = 9.8 mm (0.386")

Technical Specifications for Loader/ Unloader: Elevator/Buffer Configuration

Changeover Time	Magazine, 20 seconds
PC Board	The insertion machine determines board size.

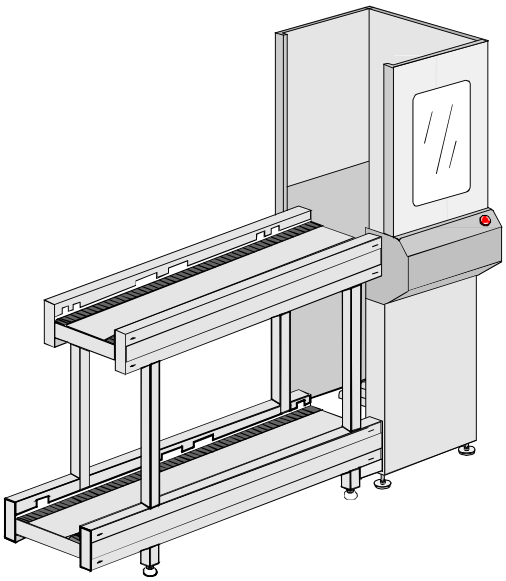
Magazine Elevators

Magazine Elevator	Controlled through insertion machine software. Power and air are supplied through the insertion machine. Elevators are equipped with emergency stops.		
Elevator Dimensions	**Length** 635mm (25")	**Depth** 838mm (33")	**Height** 1,835mm (72")

Magazine Input/Output Buffers

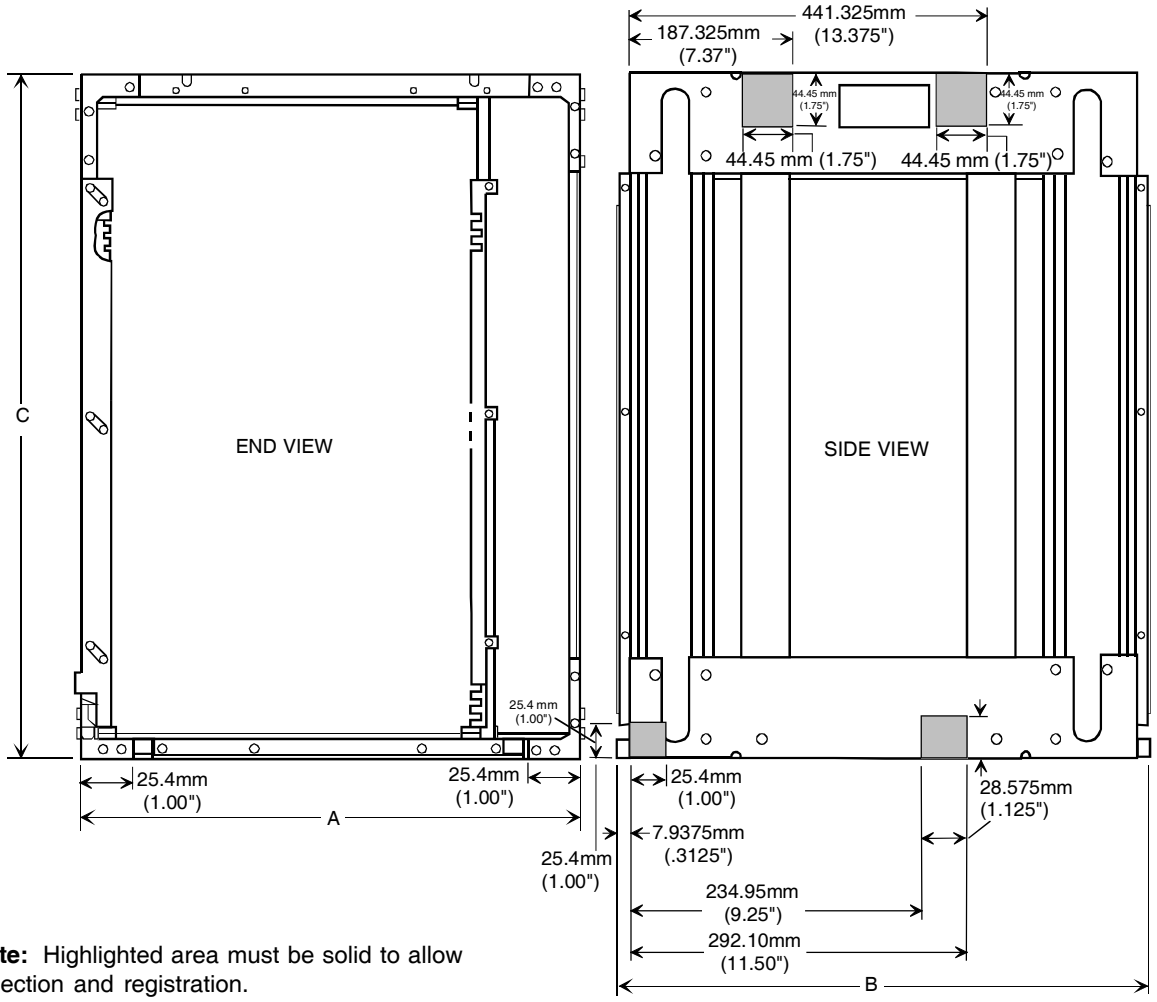
Buffer	The Buffer accomodates 2 magazines (in and out) that are up to 533mm (21") in length each. Buffers are available either with CE-compliant buffer covers or without the covers. Covers must be affixed to the Buffers in order for the Buffers to be CE-compliant.		
Buffer Dimensions With Full Covers (CE-compliant)	**Length** 1,270mm (50")	**Depth** 546mm (22")	**Height** 1,835mm (72")
Buffer Dimensions Without Covers (Not CE-compliant)	**Length** 1,270mm (50")	**Depth** 546mm (22")	**Height** 1,095mm (43")
Magazine Transfer	Upper level magazine transfer height for the Buffers is 1,056mm (42"). Lower level Magazine transfer height for the Buffers is 292mm (12").		

Buffer



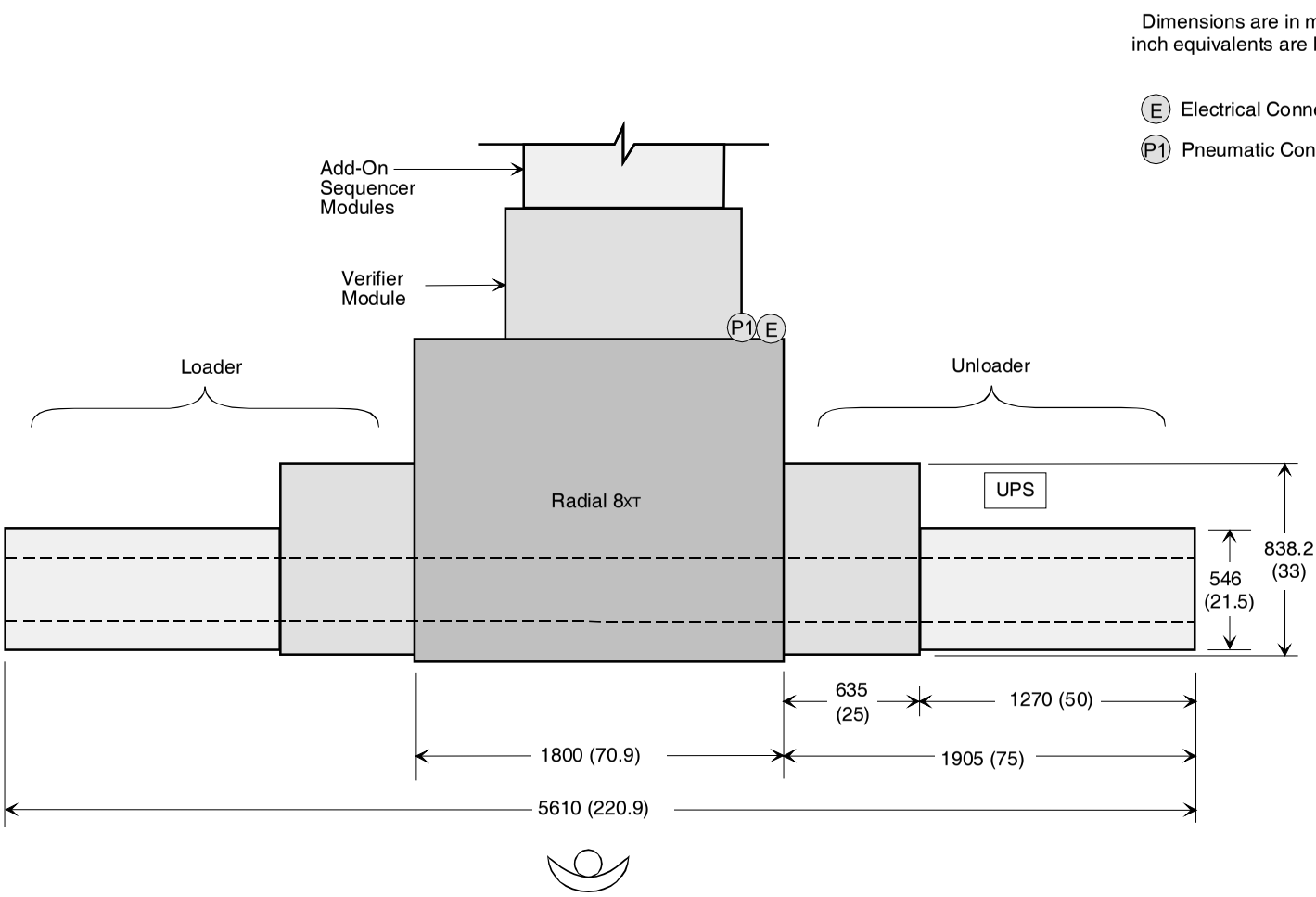
Magazine Specifications for use in Elevator Buffer System

Maximum Magazine Weight	45kg (100lbs) for PC boards plus magazines. Compatible with most commonly-used magazines. Consult a Universal Sales Engineer.			
Maximum Magazine Dimensions	**Maximum Length (B)**	**Maximum Depth (A)**	**Maximum Height (C)**	**Maximum Weight (including PC boards)**
	533mm (21")	460mm (18")	606mm (24")	45kg (100lbs)
Magazine Gate Control	If magazines have gates that must be opened by the machine, a sample magazine and a request for quote must be submitted.			



Note: Highlighted area must be solid to allow detection and registration.

MAGAZINE VIEWS



System shown in left-to-right board-flow configuration with fixed front rail.

Plan View: Radial 8XT, Magazine-to-Magazine Configuration with Buffers.

Installation Considerations: Loader/ Unloader

Magazine-to-Magazine Configuration

Dimensions—Magazine Elevator (x2)

	Length [1]	Depth	Height	Weight
Shipping Dimensions	635mm (25")	838mm (33")	1835mm (72.25")	154 kg (340 lbs.)

[1] Length is in the direction of board flow.

Dimensions—Buffer (x2)

Shipping Dimensions Not CE-Compliant	1270mm (50")	546mm (21")	1095mm (43")	91 kg (200 lbs.)
Shipping Dimensions CE-Compliant	1270mm (50")	546mm (21")	1835mm (72")	118 kg. (260 lbs.)